Access DB# 125843

SEARCH REQUEST FORM

Scientific and Technical Information Center

Requester's Full Name: LING XU Examiner # : 77924 Date: 6-28-04
Art Unit: 1775 Phone Number 30 272-1546 Serial Number: 10/602,238
Mail Box and Bldg/Room Location: 5D60 Results Format Preferred (circle): PAPER DISK E-MAIL

If more than one search is submitted, please prioritize searches in order of need.

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Please provide a detailed statement of the search topic, and describe as specifically as possible the subject matter to be searched. Include the elected species or structures, keywords, synonyms, acronyms, and registry numbers, and combine with the concept or utility of the invention. Define any terms that may have a special meaning. Give examples or relevant citations, authors, etc, if known. Please attach a copy of the cover sheet, pertinent claims, and abstract.

Title of Invention: ______

Inventors (please provide full names): ______

______

Earliest Priority Filing Date: ______

***For Sequence Searches Only* Please include all pertinent information (parent, child, divisional, or issued patent numbers) along with the appropriate serial number.**

Please see attached.

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STAFF USE ONLY	**Type of Search**	**Vendors and cost where applicable**
Searcher: ES	NA Sequence (#) ______	STN $395.59
Searcher Phone #: ______	AA Sequence (#) ______	Dialog ______
Searcher Location: ______	Structure (#) ✓ (3)	Questel/Orbit ______
Date Searcher Picked Up: ______	Bibliographic ✓ (and)	Dr.Link ______
Date Completed: 7-1-04	Litigation ______	Lexis/Nexis ______
Searcher Prep & Review Time: 5	Fulltext ______	Sequence Systems ______
~~Clerical Prep Time:~~ ______	Patent Family ______	WWW/Internet ______
Online Time: 75	Other ______	Other (specify) ______

PTO-1590 (8-01)

What is claimed is:

1. On a steel substrate a surface having a thickness from 10 to 5,000 microns comprising from 90 to 10 weight % of compounds of the formula $Mn_xCr_{3-x}O_4$ wherein x is from 0.5 to 2 and from 10 to 90 weight % of oxides of Mn and Si selected from the group consisting of MnO, $MnSiO_3$, Mn_2SiO_4 and mixtures thereof provided that the surface contains less than 5 weight % of Cr_2O_3.

2. The surface according to claim 1, in which covers not less than 85% of the surface of the substrate.

3. The surface according to claim 2, having a thickness from 10 to 1,000 microns.

4. The surface according to claim 3, comprising from 40 to 60 weight % of said spinel and from 60 to 40 weight % oxides of Mn and Si selected from the group consisting of MnO, $MnSiO_3$, Mn_2SiO_4 and mixtures thereof.

5. The surface according to claim 4, wherein Cr_2O_3 is present in an amount of less than 2 weight %.

6. A surface according to claim 5, wherein the substrate is selected from the group consisting of carbon steel, stainless steel, heat resistant

steel, HP, HT, HU, HW and HX stainless steel, and nickel or cobalt based HTA alloys.

7. The surface according to claim 6, wherein the substrate comprises from 13 to 50 weight % of Cr and from 20 to 50 weight % of Ni.

8. The surface according to claim 6, wherein the substrate comprises from 50 to 70 weight % of Ni; from 20 to 10 weight % of Cr; from 20 to 10 weight % of Co; and from 5 to 9 weight % of Fe.

9. The surface according to claim 6, wherein the substrate comprises from 40 to 65 weight % of Co; from 15 to 20 weight % of Cr; and from 20 to 13 weight % of Ni; less than 4 weight % of Fe; and up to 20 weight % of W.

10. The surface according to claim 7, wherein the oxide is MnO.

11. The surface according to claim 7, wherein the oxide is $MnSiO_3$.

12. The surface according to claim 7, wherein the oxide is Mn_2SiO_4.

13. The surface according to claim 7, wherein the oxides are mixtures of MnO, $MnSiO_3$ and Mn_2SiO_4.

14. The surface according to claim 8, wherein the oxide is MnO.

15. The surface according to claim 8, wherein the oxide is $MnSiO_3$.

16. The surface according to claim 8, wherein the oxide is Mn_2SiO_4.

17. The surface according to claim 8, wherein the oxides are mixtures of MnO, $MnSiO_3$ and Mn_2SiO_4.

18. The surface according to claim 9, wherein the oxide is MnO.

19. The surface according to claim 9, wherein the oxide is $MnSiO_3$.

20. The surface according to claim 9, wherein the oxide is Mn_2SiO_4.

21. The surface according to claim 9, wherein the oxides are mixtures of MnO, $MnSiO_3$ and Mn_2SiO_4.

22. A method of applying a composition comprising from 90 to 10 weight % of compounds of the formula $Mn_xCr_{3-x}O_4$ wherein x is from 0.5 to 2 and from 10 to 90 weight % of oxides of Mn and Si selected from the group consisting of MnO, $MnSiO_3$ and Mn_2SiO_4 and mixtures thereof provided that the composition contains less than 5 weight % of Cr_2O_3 to at least a portion of a steel substrate comprising applying said composition by a method selected from the group consisting of detonation gun spraying, cement packing, hard facing, laser cladding, plasma spraying, physical vapor deposition methods, flame spraying, and electron beam

evaporation to at least 70% of the selected surface of the steel substrate to provide a thickness from 0.1 to 5,000 microns.

23. The process according to claim 22, in which the composition covers not less than 85% of the selected surface of the substrate.

24. The process according to claim 23, wherein the surface has a thickness from 10 to 1,000 microns.

25. The process according to claim 24, comprising from 40 to 60 weight % of said spinel and from 60 to 40 weight % oxides of Mn and Si selected from the group consisting of MnO, $MnSiO_3$ and Mn_2SiO_4 and mixtures thereof.

26. The process according to claim 25, wherein Cr_2O_3 is present in an amount of less than 2 weight %.

27. The process according to claim 26, wherein the substrate is selected from the group consisting of carbon steel, stainless steel, heat resistant steel, HP, HT, HU, HW and HX stainless steel, and nickel or cobalt based HTA alloys.

28. The process according to claim 27, wherein the substrate comprises from 13 to 50 weight % of Cr and from 20 to 50 weight % of Ni.

29. The process according to claim 27, wherein the substrate comprises from 50 to 70 weight % of Ni; from 20 to 10 weight % of Cr; from 20 to 10 weight % of Co; and from 5 to 9 weight % of Fe.

30. The process according to claim 27, wherein the substrate comprises from 40 to 65 weight % of Co; from 15 to 20 weight % of Cr; and from 20 to 13 weight % of Ni, less than 4 weight % of Fe and up to 20 weight % of W.

31. The process according to claim 28, wherein the oxide is MnO.

32. The process according to claim 28, wherein the oxide is $MnSiO_3$.

33. The process according to claim 28, wherein the oxide is Mn_2SiO_4.

34. The process according to claim 28, wherein the oxides are mixtures of MnO, $MnSiO_3$ and Mn_2SiO_4.

35. The process according to claim 29, wherein the oxide is MnO.

36. The process according to claim 29, wherein the oxide is $MnSiO_3$.

37. The process according to claim 29, wherein the oxide is Mn_2SiO_4.

38. The process according to claim 29, wherein the oxides are mixtures of MnO, $MnSiO_3$ and Mn_2SiO_4.

39. The process according to claim 30, wherein the oxide is MnO.

40. The process according to claim 30, wherein the oxide is $MnSiO_3$.

41. The process according to claim 30, wherein the oxide is Mn_2SiO_4.

42. The process according to claim 30, wherein the oxides are mixtures of MnO, $MnSiO_3$ and Mn_2SiO_4.

43. A stainless steel pipe or tube having at least a portion of its inner surface comprising a composite surface according to claim 1.

44. A stainless steel reactor having at least a portion of its inner surface comprising a composite surface according to claim 1.

45. A stainless steel heat exchange having at least a portion of its inner surface comprising a composite surface according to claim 1.

46. A process for the thermal cracking of a hydrocarbon comprising passing said hydrocarbon at elevated temperatures through stainless steel tubes, pipes, or coils according to claim 43.

47. A process for altering the enthalpy of a fluid comprising passing the fluid through a heat exchanger according to claim 45.

48. A process for conducting a chemical reaction in a stainless steel reactor according to claim 44.

125843

SEARCH REQUEST FØRM

Scientific and Technical Information Center

Examiner# : 77924
Art Unit : 1775
Phone Number: 272-1546
Date: 6/28/2004
Serial Number: 10/602,238
MailBox & Bldg/Room Location: Remsem 5D60
Results Format Preferred (circle): Paper Disk E-mail

If more than one search is submitted, please prioritize searches in order of need.

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Please provide a detailed statement of the search topic, and describe as specifically as possible the subject matter to be searched. Include the elected species or structures, keywords, synonyms, acronyms, and registry numbers, and combine with the concept or utility of the invention. Define any terms that may have a special meaning. Give examples or relevant citations, authors, etc., if known. Please attach a copy of the coversheet, pertinent claims, and abstract.

Title of Invention:

Composite surface on a stainless steel matrix

Inventors (please provide full names):

Leslie Wifred Benum, Michael C. Oballa, Sabino Steven Anthony Petrone

Earliest Priority Filing Date: 6/24/2003

For Sequence Searches Only Please include all pertinent information (parent, child, divisional, or issued patent numbers) along with the appropriate serial number.

Please search the composition in claim 1, specially the composition comprising both $Mn_xCr_{3-x}O_4$ and the oxides of MnO, $MnSiO_3$ and Mn_2SiO_4

Please call me if you have any questions.

Thanks

Liying Xu

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=> file reg
FILE 'REGISTRY' ENTERED AT 21:25:00 ON 01 JUL 2004
USE IS SUBJECT TO THE TERMS OF YOUR STN CUSTOMER AGREEMENT.
PLEASE SEE "HELP USAGETERMS" FOR DETAILS.
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     FILE 'REGISTRY' ENTERED AT 20:42:19 ON 01 JUL 2004
L1        89987 S (MN(L)O)/ELS
L2           41 S L1 (L) CR/ELS (L) 3/ELC.SUB
L3          178 S L1 (L) 2/ELC.SUB
L4           32 S L1 (L) SI/ELS (L) 3/ELC.SUB

     FILE 'HCA' ENTERED AT 20:48:46 ON 01 JUL 2004
L5          445 S L2
L6        35898 S L3
L7          386 S L4
L8           71 S L5 AND L6
L9            3 S L5 AND L7
L10           1 S L8 AND L9
L11      657001 S STEEL?
L12          13 S L8 AND L11

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L13         346 S (CR(L)O)/ELS (L) 2/ELC.SUB

     FILE 'HCA' ENTERED AT 20:55:11 ON 01 JUL 2004
L14       56623 S L13 OR CR2O3

     FILE 'LCA' ENTERED AT 20:59:29 ON 01 JUL 2004
L15       10452 S (SUBSTRAT? OR SURFACE? OR BASE# OR SUBSTRUCT? OR UNDERS

     FILE 'HCA' ENTERED AT 21:00:04 ON 01 JUL 2004
L16      291875 S (METAL#### OR ALLOY?)(2A)L15
L17           2 S L8 AND L16
L18          17 S L9 OR L10 OR L12 OR L17
L19          31 S BENUM ?/AU
L20          48 S OBALLA ?/AU
L21         206 S PETRONE ?/AU
L22           2 S L19 AND L20 AND L21

     FILE 'REGISTRY' ENTERED AT 21:07:14 ON 01 JUL 2004
L23           1 S 12018-15-4
L24           1 S L2 AND L23
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L25         115 S L5 AND L11
L26       40740 S PASSIVAT?
L27           5 S L25 AND L26
L28           5 S L27 NOT L18
L29      115567 S CRACKING#
L30           5 S L25 AND L29
                E PIPES AND TUBES/CV
L31       41794 S E3

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L32           1 S 12597-68-1

     FILE 'HCA' ENTERED AT 21:18:45 ON 01 JUL 2004
L33       43418 S L32
L34           7 S L25 AND L31
L35          10 S L25 AND L33
L36         203 S L5 AND L14
L37          86 S L36 AND (L11 OR L33)
L38           7 S L37 AND (L26 OR L29 OR L31)
L39           8 S L37 AND L6
L40           0 S L37 AND L7
L41          14 S (L28 OR L30 OR L34 OR L35 OR L38 OR L39) NOT L18

     FILE 'REGISTRY' ENTERED AT 21:25:00 ON 01 JUL 2004


=> file hca
FILE 'HCA' ENTERED AT 21:34:33 ON 01 JUL 2004
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=> d l18 1-17 cbib abs hitstr hitind

L18 ANSWER 1 OF 17 HCA COPYRIGHT 2004 ACS on STN

140:238481 Lithium vanadium oxide thin-film battery. Neudecker, Bernd J.; Lanning, Bruce; Benson, Martin H.; Armstrong, Joseph H. (USA). U.S. Pat. Appl. Publ. US 2004048157 A1 20040311, 30 pp. (English). CODEN: USXXCO. APPLICATION: US 2002-238905 20020911.

AB The manuf. and use of multilayer thin-film batteries, such as inverted lithium-free batteries is explained. The present invention provides a battery that may include a lithium vanadium oxide LixV2Oy (0<x≤100, 0<y≤5) pos. cathode or neg. anode. The present invention may also provide for a thin-film battery that may be formed on a wide variety of substrate materials and geometries.

IT **1313-13-9**, Manganese dioxide, uses **268747-59-7**,

Chromium manganese oxide Cr0.5Mn0.5O2
(lithium vanadium oxide thin-film battery)

RN 1313-13-9 HCA

CN Manganese oxide (MnO2) (8CI, 9CI) (CA INDEX NAME)

O=Mn=O

RN 268747-59-7 HCA

CN Chromium manganese oxide (Cr0.5Mn0.5O2) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	2	17778-80-2
Cr	0.5	7440-47-3
Mn	0.5	7439-96-5

IC ICM H01M004-48
ICS H01M004-66; B05D005-12

NCL 429231200; 429231500; 429245000; 029623500; 427126300

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

IT 7440-50-8, Copper, uses 12054-11-4, Cusn 12597-68-1, Stainless **steel**, uses 12767-50-9, Phosphor bronze
(current collector; lithium vanadium oxide thin-film battery)

IT **1313-13-9**, Manganese dioxide, uses 1314-62-1, Vanadium oxide (V2O5), uses 7439-88-5, Iridium, uses 7440-05-3, Palladium, uses 7440-06-4, Platinum, uses 7440-22-4, Silver, uses 7440-42-8, Boron, uses 7440-43-9, Cadmium, uses 7440-57-5, Gold, uses 10045-86-0, Iron phosphate fepo4 11126-15-1, Lithium vanadium oxide 12017-95-7, Chromium lithium manganese oxide CrLiMnO4 12031-65-1, Lithium nickel oxide linio2 12031-95-7, Lithium titanium oxide li4ti5o12 12036-21-4, Vanadium oxide vo2 12037-42-2, Vanadium oxide v6o13 12039-13-3, Titanium disulfide 12057-17-9, Lithium manganese oxide limn2o4 12190-79-3, Cobalt lithium oxide colio2 12359-27-2, Vanadyl phosphate 14024-11-4, Aluminum lithium chloride allicl4 15365-14-7, Iron lithium phosphate felipo4 39457-42-6, Lithium manganese oxide 55326-82-4, Lithium titanium sulfide litis2 66102-93-0, Cobalt lithium nitride 83348-01-0, Lithium vanadyl phosphate LiVOPO4 131500-40-8, Tin nitride oxide silicide 144769-06-2, Lead oxide PbO0-2 170171-06-9, Aluminum lithium fluoride allif4 199923-81-4, Aluminum cobalt lithium oxide ((Al,Co)LiO2) 258511-25-0, Lithium manganese nitride **268747-59-7**, Chromium manganese oxide Cr0.5Mn0.5O2 371148-86-6, Tin oxide SnO0-2 666836-39-1, Tin nitride (SnN0-1.33) 666836-40-4, Indium nitride (InN0-1) 666836-41-5, Zinc nitride (ZnN0-0.67) 666836-42-6, Copper nitride (CuN0-0.33) 666836-43-7,

Nickel nitride (NiN0-0.33) 666836-44-8, Indium oxide (InO0-1.5)
(lithium vanadium oxide thin-film battery)

L18 ANSWER 2 OF 17 HCA COPYRIGHT 2004 ACS on STN
137:239007 Electrolytic Synthesis of Binary Oxide Systems Based on Manganese(II) Oxide. Nagirnyi, V. M.; Apostolova, R. D.; Baskevich, A. S.; Litvin, P. M.; Shembel', E. M. (Ukrainian State University of Chemical Engineering, Dnepropetrovsk, Ukraine). Russian Journal of Applied Chemistry (Translation of Zhurnal Prikladnoi Khimii), 75(2), 213-218 (English) 2002. CODEN: RJACEO. ISSN: 1070-4272. Publisher: MAIK Nauka/Interperiodica Publishing.

AB Joint anodic deposition of manganese, cobalt, nickel, and chromium oxides, which form binary oxide systems, from two-component sulfate solns. of the constituent metals was studied under different electrolysis conditions.

IT **39432-73-0P**, Chromium manganese oxide
(anodic deposition in bath contg. MnSO4 and Cr2(SO4)3)

RN 39432-73-0 HCA

CN Chromium manganese oxide (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	x	17778-80-2
Cr	x	7440-47-3
Mn	x	7439-96-5

IT **1313-13-9**, Manganese dioxide, properties
(morphol. of electrodeposits of)

RN 1313-13-9 HCA

CN Manganese oxide (MnO2) (8CI, 9CI) (CA INDEX NAME)

CC 72-4 (Electrochemistry)
Section cross-reference(s): 78

IT Electrodeposition
(kinetics; of manganese binary oxides on **steel** anode in sulfate bath)

IT Electrodeposition
(of manganese binary oxides on **steel** in sulfate bath)

IT **39432-73-0P**, Chromium manganese oxide
(anodic deposition in bath contg. MnSO4 and Cr2(SO4)3)

IT 1308-04-9, Cobalt oxide co2o3 **1313-13-9**, Manganese dioxide, properties
(morphol. of electrodeposits of)

L18 ANSWER 3 OF 17 HCA
136:312578 Interconnector for a high temperature fuel cell. Tietz, Frank; Gupta, Ashok; Teller, Oliver (Forschungszentrum Juelich G.m.b.H., Germany). Ger. Offen. DE 10050010 A1 20020418, 6 pp. (German). CODEN: GWXXBX. APPLICATION: DE 2000-10050010 20001010.

AB A ceramic layer of manganese or cobalt oxide, or a mixed manganese oxide, is applied as thin protective layer on the **steel** interconnector of a fuel cell. It has the following advantageous characteristics: good elec. cond., slight porosity to prevent corrosion of the **steel** by air and eventual contamination of the cathode by Cr from the **steel**, and high chem. compatibility to avoid chem. reactions between interconnector **steel** and the contact layer that may form conductive corrosion products.

IT **1313-13-9D**, Manganese oxide (MnO2), layer on **steel**
1317-35-7D, Manganese oxide (Mn3O4), also contg. chromium, cobalt, titanium, iron, or nickel and chromium, cobalt, titanium, iron, nickel, vanadium, yttrium tungsten or lanthanides
107874-75-9, Chromium manganese oxide ((CrMn)3O4)
(interconnector for a high temp. fuel cell)

RN 1313-13-9 HCA
CN Manganese oxide (MnO2) (8CI, 9CI) (CA INDEX NAME)

RN 1317-35-7 HCA
CN Manganese oxide (Mn3O4) (8CI, 9CI) (CA INDEX NAME)
*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
RN 107874-75-9 HCA
CN Chromium manganese oxide ((Cr,Mn)3O4) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Cr	0 - 3	7440-47-3
Mn	0 - 3	7439-96-5

IC ICM H01M008-02
ICS H01M008-12
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 55, 57
ST fuel cell **steel** interconnector manganese oxide resistance corrosion porosity
IT Cast alloys
(chromium **steel**; interconnector for a high temp. fuel cell)

IT **1313-13-9D**, Manganese oxide (MnO_2), layer on **steel**
1317-35-7D, Manganese oxide (Mn_3O_4), also contg. chromium, cobalt, titanium, iron, or nickel and chromium, cobalt, titanium, iron, nickel, vanadium, yttrium tungsten or lanthanides
7440-02-0D, Nickel, manganese oxide contg. 7440-32-6D, Titanium, manganese oxide contg. 7440-33-7D, Tungsten, manganese oxide contg. 7440-47-3D, Chromium, manganese oxide contg. 7440-48-4D, Cobalt, manganese oxide contg. 7440-62-2D, Vanadium, manganese oxide contg. 7440-65-5D, Yttrium, manganese oxide contg.
11104-61-3, Cobalt oxide 58984-36-4, Cobalt lanthanum oxide
61115-22-8, Lanthanum manganese oxide **107874-75-9**, Chromium manganese oxide ($(CrMn)_3O_4$) 110621-22-2, Cobalt manganese oxide ($(CoMn)_3O_4$)
(interconnector for a high temp. fuel cell)

IT 12597-69-2D, **Steel**, with manganese dioxide layer, uses
(interconnector for a high temp. fuel cell)

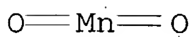
L18 ANSWER 4 OF 17 HCA COPYRIGHT 2004 ACS on STN
136:21977 Doped manganese dioxides for use in battery electrodes. Feddrix, Frank H.; Donne, Scott W.; Devenney, Martin; Gorer, Alexander (Eveready Battery Company, Inc., USA). PCT Int. Appl. WO 2001093348 A2 20011206, 59 pp. DESIGNATED STATES: W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY, DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG, TR. (English). CODEN: PIXXD2. APPLICATION: WO 2001-US17737 20010601. PRIORITY: US 2000-PV208610 20000601.

AB This invention relates to batteries and, more particularly, to battery electrodes comprised of manganese dioxide doped with at least one element. In one aspect, the invention is a doped manganese dioxide useful as an active electrode material in both thin film and cylindrical batteries. The doped manganese dioxides provide several potential benefits, including improved electrochem. performance as compared with conventional manganese dioxides. The doped manganese dioxides of this invention comprise manganese, oxygen, and at least one dopant deliberately incorporated into the at. structure of the manganese dioxide. The doped Mn dioxide electrode materials may be produced by a wet chem. method (CMD) or may be prepd. electrolytically (EMD) using a soln. contg. Mn sulfate, H_2SO_4, and a dopant, in which the dopant is present in an amt. of at least .apprx.25 ppm.

IT **1313-13-9**, Manganese dioxide, uses **378248-54-5**, Manganese oxide silicate (Mn0.99-101.86-2(SiO4)0-0.01)
378248-59-0, Chromium manganese oxide (Cr0-0.01Mn0.99-101.9-

2)
(doped manganese dioxides for use in battery electrodes)

RN 1313-13-9 HCA
CN Manganese oxide (MnO2) (8CI, 9CI) (CA INDEX NAME)



RN 378248-54-5 HCA
CN Manganese oxide silicate (Mn0.99-1O1.86-2(SiO4)0-0.01) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	1.86 - 2	17778-80-2
O4Si	0 - 0.01	17181-37-2
Mn	0.99 - 1	7439-96-5

RN 378248-59-0 HCA
CN Chromium manganese oxide (Cr0-0.01Mn0.99-1O1.9-2) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	1.9 - 2	17778-80-2
Cr	0 - 0.01	7440-47-3
Mn	0.99 - 1	7439-96-5

IC ICM H01M
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 57, 76
IT **1313-13-9**, Manganese dioxide, uses 7440-44-0, Carbon, uses 7782-42-5, Graphite, uses 378248-51-2, Manganese borate oxide (Mn0.99-1(BO3)0-0.01O1.87-2) 378248-52-3, Magnesium manganese oxide (Mg0-0.01Mn0.99-1O1.9-2) 378248-53-4, Aluminum manganese oxide (Al0-0.01Mn0.99-1O1.9-2) **378248-54-5**, Manganese oxide silicate (Mn0.99-1O1.86-2(SiO4)0-0.01) 378248-55-6, Manganese oxide phosphate (Mn0.99-1O1.86-2(PO4)0-0.01) 378248-56-7, Manganese scandium oxide (Mn0.99-1Sc0-0.01O1.9-2) 378248-57-8, Manganese titanium oxide (Mn0.99-1Ti0-0.01O1.9-2) 378248-58-9, Manganese vanadium oxide (Mn0.99-1V0-0.01O1.9-2) **378248-59-0**, Chromium manganese oxide (Cr0-0.01Mn0.99-1O1.9-2) 378248-60-3, Iron manganese oxide (Fe0-0.01Mn0.99-1O1.9-2) 378248-61-4, Cobalt manganese oxide (Co0-0.01Mn0.99-1O1.9-2) 378248-62-5, Manganese nickel oxide (Mn0.99-1Ni0-0.01O1.9-2) 378248-63-6, Copper manganese oxide (Cu0-0.01Mn0.99-1O1.9-2)

378248-64-7, Manganese zinc oxide (Mn0.99-1Zn0-0.01O1.9-2)
378248-65-8, Gallium manganese oxide (Ga0-0.01Mn0.99-1O1.9-2)
378248-66-9, Germanium manganese oxide (Ge0-0.01Mn0.99-1O1.9-2)
378248-67-0, Manganese strontium oxide (Mn0.99-1Sr0-0.01O1.9-2)
378248-68-1, Manganese yttrium oxide (Mn0.99-1Y0-0.01O1.9-2)
378248-69-2, Manganese zirconium oxide (Mn0.99-1Zr0-0.01O1.9-2)
378248-70-5, Manganese niobium oxide (Mn0.99-1Nb0-0.01O1.9-2)
378248-71-6, Manganese ruthenium oxide (Mn0.99-1Ru0-0.01O1.9-2)
378248-72-7, Manganese rhodium oxide (Mn0.99-1Rh0-0.01O1.9-2)
378248-73-8, Manganese palladium oxide (Mn0.99-1Pd0-0.01O1.9-2)
378248-74-9, Manganese silver oxide (Mn0.99-1Ag0-0.01O1.9-2)
378248-75-0, Indium manganese oxide (In0-0.01Mn0.99-1O1.9-2)
378248-76-1, Manganese tin oxide (Mn0.99-1Sn0-0.01O1.9-2)
378248-77-2, Barium manganese oxide (Ba0-0.01Mn0.99-1O1.9-2)
378248-78-3, Cerium manganese oxide (Ce0-0.01Mn0.99-1O1.9-2)
378248-79-4, Hafnium manganese oxide (Hf0-0.01Mn0.99-1O1.9-2)
378248-80-7, Manganese tantalum oxide (Mn0.99-1Ta0-0.01O1.9-2)
378248-81-8, Manganese rhenium oxide (Mn0.99-1Re0-0.01O1.9-2)
378248-82-9, Manganese osmium oxide (Mn0.99-1Os0-0.01O1.9-2)
378248-83-0, Iridium manganese oxide (Ir0-0.01Mn0.99-1O1.9-2)
378248-84-1, Manganese platinum oxide (Mn0.99-1Pt0-0.01O1.9-2)
378248-85-2, Gold manganese oxide (Au0-0.01Mn0.99-1O1.9-2)
378248-86-3, Bismuth manganese oxide (Bi0-0.01Mn0.99-1O1.9-2)
378248-87-4, Aluminum manganese nickel oxide (Al0-0.01Mn0.99-1Ni0-0.01O1.9-2) 378248-88-5, Manganese nickel borate oxide (Mn0.99-1Ni0-0.01(BO3)0-0.01O1.87-2) 378248-89-6, Manganese zirconium borate oxide (Mn0.99-1Zr0-0.01(BO3)0-0.01O1.87-2) 378248-90-9, Manganese titanium borate oxide (Mn0.99-1Ti0-0.01(BO3)0-0.01O1.87-2) 378248-91-0, Hafnium manganese borate oxide (Hf0-0.01Mn0.99-1(BO3)0-0.01O1.87-2) 378248-92-1, Aluminum manganese tantalum oxide (Al0-0.01Mn0.99-1Ta0-0.01O1.9-2) 378248-93-2, Manganese tantalum borate oxide (Mn0.99-1Ta0-0.01(BO3)0-0.01O1.87-2) 378248-94-3, Manganese niobium borate oxide (Mn0.99-1Nb0-0.01(BO3)0-0.01O1.87-2) 378248-95-4, Aluminum manganese niobium oxide (Al0-0.01Mn0.99-1Nb0-0.01O1.9-2) 378248-96-5, Manganese niobium zirconium oxide (Mn0.99-1Nb0-0.01Zr0-0.01O1.9-2) 378248-97-6, Aluminum manganese zirconium oxide (Al0-0.01Mn0.99-1Zr0-0.01O1.9-2) 378248-98-7, Gallium manganese zirconium oxide (Ga0-0.01Mn0.99-1Zr0-0.01O1.9-2) 378248-99-8, Cerium manganese zirconium oxide (Ce0-0.01Mn0.99-1Zr0-0.01O1.9-2) 378249-00-4, Hafnium manganese zinc oxide (Hf0-0.01Mn0.99-1Zn0-0.01O1.9-2) 378249-01-5, Cerium manganese borate oxide (Ce0-0.01Mn0.99-1(BO3)0-0.01O1.87-2) 378249-02-6, Gallium manganese borate oxide (Ga0-0.01Mn0.99-1(BO3)0-0.01O1.87-2) 378249-03-7, Cerium hafnium manganese oxide (Ce0-0.01Hf0-0.01Mn0.99-1O1.9-2) 378249-04-8, Aluminum manganese borate oxide (Al0-0.01Mn0.99-1(BO3)0-0.01O1.87-2) 378249-05-9, Aluminum gallium manganese oxide (Al0-0.01Ga0-0.01Mn0.99-1O1.9-2) 378249-06-0,

Manganese zinc borate oxide (Mn0.99-1Zn0-0.01(BO3)0-0.01O1.87-2) 378249-07-1, Cerium manganese zinc oxide (Ce0-0.01Mn0.99-1Zn0-0.01O1.9-2) 378249-08-2, Cerium gallium manganese oxide (Ce0-0.01Ga0-0.01Mn0.99-1O1.9-2) 378249-09-3, Aluminum hafnium manganese oxide (Al0-0.01Hf0-0.01Mn0.99-1O1.9-2) 378249-10-6, Hafnium manganese zirconium oxide (Hf0-0.01Mn0.99-1Zr0-0.01O1.9-2) 378249-11-7, Manganese zinc zirconium oxide (Mn0.99-1Zn0-0.01Zr0-0.01O1.9-2) 378249-12-8, Gallium hafnium manganese oxide (Ga0-0.01Hf0-0.01Mn0.99-1O1.9-2) 378249-13-9, Gallium manganese nickel oxide (Ga0-0.01Mn0.99-1Ni0-0.01O1.9-2) 378249-14-0, Manganese nickel zinc oxide (Mn0.99-1Ni0-0.01Zn0-0.01O1.9-2) 378249-15-1, Gallium manganese silver oxide (Ga0-0.01Mn0.99-1Ag0-0.01O1.9-2) 378249-16-2, Indium manganese nickel oxide (In0-0.01Mn0.99-1Ni0-0.01O1.9-2) 378249-17-3, Hafnium manganese nickel oxide (Hf0-0.01Mn0.99-1Ni0-0.01O1.9-2) 378249-18-4, Indium manganese zirconium oxide (In0-0.01Mn0.99-1Zr0-0.01O1.9-2) 378249-19-5, Manganese silver borate oxide (Mn0.99-1Ag0-0.01(BO3)0-0.01O1.87-2) 378249-20-8, Aluminum manganese zinc oxide (Al0-0.01Mn0.99-1Zn0-0.01O1.9-2) 378249-21-9, Gallium manganese zinc oxide (Ga0-0.01Mn0.99-1Zn0-0.01O1.9-2) 378249-22-0, Chromium manganese borate oxide (Cr0-0.01Mn0.99-1(BO3)0-0.01O1.87-2) 378249-23-1, Chromium manganese zinc oxide (Cr0-0.01Mn0.99-1Zn0-0.01O1.9-2) 378249-24-2, Aluminum chromium manganese oxide (Al0-0.01Cr0-0.01Mn0.99-1O1.9-2) 378249-25-3, Chromium indium manganese oxide (Cr0-0.01In0-0.01Mn0.99-1O1.9-2) 378249-26-4, Chromium gallium manganese oxide (Cr0-0.01Ga0-0.01Mn0.99-1O1.9-2) 378249-27-5, Chromium hafnium manganese oxide (Cr0-0.01Hf0-0.01Mn0.99-1O1.9-2) 378249-28-6, Manganese nickel silver oxide (Mn0.99-1Ni0-0.01Ag0-0.01O1.9-2) 378249-29-7, Aluminum manganese silver oxide (Al0-0.01Mn0.99-1Ag0-0.01O1.9-2) 378249-30-0, Chromium manganese silver oxide (Cr0-0.01Mn0.99-1Ag0-0.01O1.9-2) 378249-31-1, Cerium chromium manganese oxide (Ce0-0.01Cr0-0.01Mn0.99-1O1.9-2) 378249-32-2, Chromium manganese zirconium oxide (Cr0-0.01Mn0.99-1Zr0-0.01O1.9-2) 378249-33-3, Manganese silver zirconium oxide (Mn0.99-1Ag0-0.01Zr0-0.01O1.9-2) 378249-34-4, Cerium manganese silver oxide (Ce0-0.01Mn0.99-1Ag0-0.01O1.9-2) 378249-35-5, Chromium copper manganese oxide (Cr0-0.01Cu0-0.01Mn0.99-1O1.9-2) 378249-36-6, Copper manganese zirconium oxide (Cu0-0.01Mn0.99-1Zr0-0.01O1.9-2) 378249-37-7, Hafnium manganese silver oxide (Hf0-0.01Mn0.99-1Ag0-0.01O1.9-2) 378249-38-8, Manganese silver zinc oxide (Mn0.99-1Ag0-0.01Zn0-0.01O1.9-2) 378249-39-9, Manganese ruthenium zirconium oxide (Mn0.99-1Ru0-0.01Zr0-0.01O1.9-2) 378249-40-2, Cerium manganese ruthenium oxide (Ce0-0.01Mn0.99-1Ru0-0.01O1.9-2) 378249-41-3, Hafnium manganese ruthenium oxide (Hf0-0.01Mn0.99-1Ru0-0.01O1.9-2) 378249-42-4, Aluminum manganese ruthenium oxide (Al0-0.01Mn0.99-1Ru0-0.01O1.9-2) 378249-43-5 378249-44-6, Aluminum cerium manganese titanium oxide (Al0-0.01Ce0-0.01Mn0.99-1Ti0-0.01O1.9-2)

378249-45-7 378249-46-8, Aluminum manganese nickel titanium oxide (Al0-0.01Mn0.99-1Ni0-0.01Ti0-0.01O1.9-2) 378249-47-9, Aluminum cerium manganese nickel oxide (Al0-0.01Ce0-0.01Mn0.99-1Ni0-0.01O1.9-2) 378249-49-1 378249-50-4, Hafnium manganese nickel zirconium oxide (Hf0-0.01Mn0.99-1Ni0-0.01Zr0-0.01O1.9-2) 378249-51-5, Hafnium manganese zinc zirconium oxide (Hf0-0.01Mn0.99-1Zn0-0.01Zr0-0.01O1.9-2) 378249-52-6 378249-53-7 378249-54-8 378253-12-4, Antimony manganese oxide (Sb0-0.01Mn0.99-1O1.9-2) 378253-13-5, Chromium manganese nickel oxide (Cr0-0.01Mn0.99-1Ni0-0.01O1.9-2) 378253-14-6, Cerium manganese nickel titanium oxide (Ce0-0.01Mn0.99-1Ni0-0.01Ti0-0.01O1.9-2)
(doped manganese dioxides for use in battery electrodes)

L18 ANSWER 5 OF 17 HCA COPYRIGHT 2004 ACS on STN

135:8639 High-temperature oxidation studies of low-nickel austenitic stainless **steel**. Part II: cyclic oxidation. Perez, F. J.; Cristobal, M. J.; Hierro, M. P. (Departamento de Ciencia de los Materiales, Facultad de Quimica, Universidad Complutense, Madrid, 28040, Spain). Oxidation of Metals, 55(1/2), 165-175 (English) 2001. CODEN: OXMEAF. ISSN: 0030-770X. Publisher: Kluwer Academic/Plenum Publishers.

AB The cyclic-oxidn. behavior of a "low-nickel austenitic stainless **steel**" (LNiSS) at 873 and 973 K has been investigated up to 500 cycles. A wide range of exptl. techniques, including SEM, EDS, and XRD have been applied to examine the oxide scales. After cyclic oxidn. at 873 and 973 K, the new LNiSS alloy showed good oxidn. resistance. XRD and EDS anal. show that compn. of oxide scales developed during cyclic oxidn. at 873 and 973 K are the same. The oxide scales formed a cubic oxide-type M2O3 and a cubic spinel-type M3O4 adhered well to the substrate.

IT **1317-34-6**, manganese oxide Mn2O3 **12018-15-4**, chromium manganese oxide Cr2MnO4 **60645-62-7**, Chromium manganese oxide (Cr3Mn3O8)
(oxide scale contg.; high-temp. cyclic oxidn. of low-nickel austenitic stainless **steel**)

RN 1317-34-6 HCA

CN Manganese oxide (Mn2O3) (8CI, 9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

RN 12018-15-4 HCA

CN Chromium manganese oxide (Cr2MnO4) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Cr	2	7440-47-3
Mn	1	7439-96-5

RN 60645-62-7 HCA
CN Chromium manganese oxide (Cr3Mn3O8) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	8	17778-80-2
Cr	3	7440-47-3
Mn	3	7439-96-5

CC 56-10 (Nonferrous Metals and Alloys)
ST austenitic stainless **steel** cyclic oxidn
IT Scale (deposits)
(oxide; high-temp. cyclic oxidn. of low-nickel austenitic stainless **steel**)
IT Oxidation
(thermal, cyclic; high-temp. cyclic oxidn. of low-nickel austenitic stainless **steel**)
IT 341511-45-3
(high-temp. cyclic oxidn. of low-nickel austenitic stainless **steel**)
IT **1317-34-6**, manganese oxide Mn2O3 **12018-15-4**, chromium manganese oxide Cr2MnO4 **60645-62-7**, Chromium manganese oxide (Cr3Mn3O8) 75864-23-2, Iron manganese oxide (Fe,Mn)2O3
(oxide scale contg.; high-temp. cyclic oxidn. of low-nickel austenitic stainless **steel**)

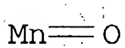
L18 ANSWER 6 OF 17 HCA
134:103748 Optimisation of the high temperature oxidation behaviour of conventional stainless **steel** by surface-applied rare earth elements. Odriozola, J. A.; Botella, J.; Soares, J. C.; Lefebvre, S. (Avenida Americo Vespucio s/n, Universidad de Sevilla, Seville, E-41092, Luxembourg). European Commission, [Report] EUR, EUR 19394, 1-131 (English) 2000. CODEN: CECED9. ISSN: 1018-5593.
AB The main goal of this study is to optimize the high temp. oxidn. resistance of conventional austenitic stainless **steels** by surface modification with rare earth elements (REE). The achievement of this goal has 3 well differentiated parts: the study of deposition methods paying particular attention to the total cost of the process; the characterization of the oxide scales formed after oxidn. as a way of understanding the REE effect, at least from a phenomenol. point of view; and the attempt to provide explanations for the REE on the basis of the collected data and numerical simulations of model systems. We first selected the exptl. conditions in which our modified AISI-304 stainless **steels** have to work. Two main aspects have to be considered in this point, first the temp. and the oxidizing agent, second the possibility of

secondary reactions due to the presence of contaminants (e.g. H2O, CO2, SO2, etc.). As the main aspect was to increase the service temp. of AISI-304 **steels** to the intermediate temp. range 1100-1300 K we decided to work in pure synthetic air eliminating the possible influence of external agents. The direct modification of the **steel** surface by applying the reactive elements and the chem. modification of this surface prior to the addn. of lanthanide elements were investigated. The investigation has lead to explore the effect of annealing treatments in the case of the ion implanted specimens as well as the above described procedures. The elements selected to modify the **steel** surface, La and Ce, were chosen on the basis of exploratory research performed at ACERINOX and the University of Sevilla and their effect is well documented in the literature, particularly in the case of Ce, since much less work as done with La. Four different surface modification methods were used: 1. spray-coating using La nitrate solns., 2. pyrolysis of aerosols, 3. ion exchange, and 4. ion implantation. Whatever the deposition method the enhancement of the protective behavior of the oxide scale formed upon oxidn. at 1173 K is evident. However, the modification with La is by far preferably since the wt. gain, scale thickness, and adherence is upgraded with respect to Ce-modified specimens. If the specimen is implanted with La a pseudoparabolic behavior is obsd. up to 90 h oxidn. while in the case of Ce a break in the wt. gain vs time curves is obsd. at around 16 h even though the wt. gain for Ce-modified **steels** is 4-fold lower than the untreated **steels**. If the modification is performed by pyrolysis of aerosols it can be said that the La-modified surfaces behaves 2.5 times better than Ce-modified ones. Preoxidn. of the **steel** surface before lanthanide element addn. has almost no effect on the oxidn. kinetics of La-modified **steels**, only for long oxidn. times, over 100 h, a slight improvement with respect to La-modification over the bare **steel** is obsd. whatever the deposition procedure, spray coating or pyrolysis of aerosols. On the contrary, preoxidn. prior to Ce addn. reduces the O2 wt. gain by a factor of 2. The facts may indicate that the initial stages of the interaction between lanthanide elements and the **steel** surface det. the course of the oxidn. behavior. The preoxidn. treatment generates a thin oxide layer modified by the addn. of lanthanide elements that slow down cation and anion diffusion improving the oxidn. behavior of the **steel**. If the modification is carried out over the bare **steel**, wet oxidn. of the **steel** takes place creating an oxide layer whose characteristics are different that those generated by dry O2 at high temps. The main difference between La and Ce dispersion in the oxide scale is their ability to form, at high temp., perovskite phases with the main components of the oxide scale. The state is +4. This clearly affects the formation of perovskite phases, LnMO3, that are possible with La but

not with Ce at least in highly oxidizing environments. XRD patterns of the oxide scales support these considerations since LaCrO3 diffraction lines are clearly visible whereas only CeO2 diffraction lines appear in Ce-modified **steels**. The cryst. structure of the oxide layers grown on the stainless **steels** after oxidn. are mainly formed by spinel-type MnCr2O4 at the air-oxide interface, below which an La-rich layer appears, Cr2O3 in the inside, and a nearly continuous SiO2 layer at the oxide-alloy interface. Theor. modeling of the diffusion phenomena using mol. dynamics simulations has proved that, for pure M2O3 where M stands for Fe, Cr or both, diffusion processes start at the surface at temps. much higher than those used in the present work. The existence of defects in these crystals only favors diffusion of vacancies along the C3 axis of the cryst. structure with fast relaxation times. The presence of excess oxygen at the surface favors diffusion through grain boundaries mainly by anions. A model that simulates grain boundaries was constructed and the diffusion process studied through it with and without La. The presence of La blocks cation diffusion and slows down anion diffusion along grain boundaries. The presence of intermediate layers where La appears should block diffusion through these layers enhancing the protective behavior of the oxide scale.

IT **1344-43-0**, Manganese oxide MnO, processes **12018-15-4**
, Chromium manganese oxide Cr2MnO4
(oxide scale component; optimization of high-temp. oxidn. resistance of conventional stainless **steel** by surface-applied rare earth elements)

RN 1344-43-0 HCA
CN Manganese oxide (MnO) (8CI, 9CI) (CA INDEX NAME)



RN 12018-15-4 HCA
CN Chromium manganese oxide (Cr2MnO4) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Cr	2	7440-47-3
Mn	1	7439-96-5

CC 55-10 (Ferrous Metals and Alloys)
ST stainless **steel** oxidn resistance cerium lanthanum coating
IT Diffusion
(in lanthanide oxide scale; optimization of high-temp. oxidn. resistance of conventional stainless **steel** by

surface-applied rare earth elements)
IT Simulation and Modeling, physicochemical
(mol. dynamics; in optimization of high-temp. oxidn. resistance of conventional stainless **steel** by surface-applied rare earth elements)
IT Annealing
(of ion-implanted specimens; optimization of high-temp. oxidn. resistance of conventional stainless **steel** by surface-applied rare earth elements)
IT Spalling
(of oxide scale; optimization of high-temp. oxidn. resistance of conventional stainless **steel** by surface-applied rare earth elements)
IT Ion implantation
Oxidation kinetics
(optimization of high-temp. oxidn. resistance of conventional stainless **steel** by surface-applied rare earth elements)
IT Scale (deposits)
(oxide, protective lanthanide; optimization of high-temp. oxidn. resistance of conventional stainless **steel** by surface-applied rare earth elements)
IT Coating materials
(oxidn.-resistant; optimization of high-temp. oxidn. resistance of conventional stainless **steel** by surface-applied rare earth elements)
IT Coating process
(spray; optimization of high-temp. oxidn. resistance of conventional stainless **steel** by surface-applied rare earth elements)
IT Oxidation
(thermal; optimization of high-temp. oxidn. resistance of conventional stainless **steel** by surface-applied rare earth elements)
IT 10277-43-7, Lanthanum nitrate La(NO3)3 hexahydrate 10294-41-4, Cerium nitrate Ce(NO3)3 hexahydrate
(coating precursor; optimization of high-temp. oxidn. resistance of conventional stainless **steel** by surface-applied rare earth elements)
IT 7439-91-0, Lanthanum, processes 7440-45-1, Cerium, processes
(coatings; optimization of high-temp. oxidn. resistance of conventional stainless **steel** by surface-applied rare earth elements)
IT 11109-50-5, AISI 304 37301-67-0, AISI 310S 318497-30-2, ACX330
(optimization of high-temp. oxidn. resistance of conventional stainless **steel** by surface-applied rare earth elements)
IT 1306-38-3, Cerium dioxide, processes 1308-38-9, Chromia, processes 1309-37-1, Iron sesquioxide, processes 1312-81-8, Lanthanum oxide **1344-43-0**, Manganese oxide MnO, processes 7631-86-9,

Silica, processes 12017-94-6, Chromium lanthanum oxide CrLaO3
12018-15-4, Chromium manganese oxide Cr2MnO4 12022-43-4,
Iron lanthanum oxide FeLaO3 12063-10-4, Iron manganese oxide
Fe2MnO4 12433-24-8, Chromium lanthanum oxide CrLaO4 79103-48-3,
Lanthanum nickel oxide La3Ni2O7 86855-92-7, Lanthanum nickel oxide
LaNiO2 87139-00-2, Lanthanum nickel oxide La2Ni2O5 109414-04-2,
Chromium iron oxide (Cr,Fe)2O3 120604-89-9, Chromium iron oxide
Cr0.8Fe1.2O3 150547-53-8, Chromium iron oxide Cr1.3Fe0.7O3
180180-35-2, Chromium iron oxide Cr1.94Fe0.06O3
(oxide scale component; optimization of high-temp. oxidn. resistance of conventional stainless **steel** by surface-applied rare earth elements)

L18 ANSWER 7 OF 17 HCA COPYRIGHT 2004 ACS on STN
129:125193 High temperature phase and thermodynamic relations in selected MnO-CrOx systems. Garbers-Craig, Andrie M.; Dippenaar, Rian J. (Research and Development, Iscor Limited, Pretoria, 0001, S. Afr.). Proceedings of the International Conference on Molten Slags, Fluxes and Salts '97, 5th, Sydney, Jan. 5-8, 1997, 413-420. Iron and Steel Society: Warrendale, Pa. (English) 1997. CODEN: 66IUAE.

AB Phase and thermodn. relations in MnO-CrOx-contg. systems were examd. in order to establish a knowledge base for the substitution of nickel in stainless **steels** by manganese. Phase relations were detd. in the pseudo-binary and ternary systems which constitute the (MnO-CrOx-CaO-SiO2) system, under **steelmaking** conditions (i.e. high temps. and highly reducing conditions). The most prominent characteristic common to these MnO-CrOx-contg. systems, is the dominance of the (Mn,Cr)3O4 spinel phase and the small all-liq. phase fields. MnO activity-compn. relations were detd. in (MnO-CrOx-CaO-SiO2)-contg. melts, which were satd. with the (Mn,Cr)3O4 spinel phase, using the gas-slag-platinum equilibration technique. By using the exptl. detd. values for $\ln\gamma_{Mn}$ in Pt-Cr-Mn alloys, the MnO activities and MnO activity coeffs. were calcd. An increase in the concn. of MnO in the melt increases both the MnO activity and the MnO activity coeff. For a const. MnO concn. in the melt, the activity of MnO (and therefore the activity coeff. of MnO) is increased by an increase in the basicity of the melt.

IT **107874-75-9**, Chromium manganese oxide (cr,mn)3O4
(high temp. phase and thermodn. relations in MnO-CrOx systems)

RN 107874-75-9 HCA

CN Chromium manganese oxide ((Cr,Mn)3O4) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Cr	0 - 3	7440-47-3

Mn	0 - 3	7439-96-5

IT **1344-43-0**, Manganese oxide mno, properties
(systems; high temp. phase and thermodn. relations in MnO-CrOx systems)
RN 1344-43-0 HCA
CN Manganese oxide (MnO) (8CI, 9CI) (CA INDEX NAME)

Mn═O

CC 55-1 (Ferrous Metals and Alloys)
Section cross-reference(s): 68
ST manganese oxide chromium activity stainless **steelmaking;** slag stainless **steelmaking** manganese phase diagram
IT Slags
(**steelmaking;** high temp. phase and thermodn. relations in MnO-CrOx systems)
IT **107874-75-9**, Chromium manganese oxide (cr,mn)304
(high temp. phase and thermodn. relations in MnO-CrOx systems)
IT 1305-78-8, Calcia, properties 1308-38-9, Chromia, properties **1344-43-0**, Manganese oxide mno, properties 7631-86-9, Silica, properties
(systems; high temp. phase and thermodn. relations in MnO-CrOx systems)

L18 ANSWER 8 OF 17 HCA COPYRIGHT 2004 ACS on STN
125:281693 Removal of copper and tin from molten iron. Nishi, Takayuki; Matsuo, Tooru (Sumitomo Metal Industries, Ltd., Japan). Jpn. Kokai Tokkyo Koho JP 08199216 A2 19960806 Heisei, 7 pp. (Japanese). CODEN: JKXXAF. APPLICATION: JP 1995-12511 19950130.
AB In the removal of Cu and Sn by decarburizing C-contg. molten iron with powd. refining agents at ≤10 Torr, the agents comprise composite oxides from (a) oxides of Fe, Mn, Cr, and/or Si and (b) oxides of Si, Mg, Ti, Al, and/or Zr. Cu and Sn are efficiently removed in short time, and the process is suitable for treatment of molten iron contg. scraps.
IT **39432-73-0**, Chromium manganese oxide **178958-60-6**, Manganese silicon oxide
(removal of copper and tin from molten iron by decarburization with composite oxides)
RN 39432-73-0 HCA
CN Chromium manganese oxide (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	x	17778-80-2

Cr	x	7440-47-3
Mn	x	7439-96-5

RN 178958-60-6 HCA
CN Manganese silicon oxide (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	x	17778-80-2
Si	x	7440-21-3
Mn	x	7439-96-5

IC ICM C21C001-04
ICS C21C007-04; C21C007-10
CC 55-1 (Ferrous Metals and Alloys)
Section cross-reference(s): 54
IT 12673-39-1, Iron silicon oxide 12789-64-9, Iron titanium oxide 39361-81-4, Iron zirconium oxide **39432-73-0**, Chromium manganese oxide 50957-60-3, Aluminum manganese oxide 155553-85-8, Magnesium silicon oxide 174633-44-4, Silicon zirconium oxide **178958-60-6**, Manganese silicon oxide
(removal of copper and tin from molten iron by decarburization with composite oxides)

L18 ANSWER 9 OF 17 HCA
123:292925 Study of the reaction of lanthanum nitrate with metal oxides present in the scale formed at high temperatures on stainless **steel**. Ruiz, M. I.; Heredia, A.; Botella, J.; Odriozola, J. A. (Acerinox, S. A. Los Barrios, Cadiz, Spain). Journal of Materials Science, 30(20), 5146-50 (English) 1995. CODEN: JMTSAS. ISSN: 0022-2461. Publisher: Chapman & Hall.
AB The reaction of lanthanum nitrate with metallic oxides that can be present in the oxide scales formed at elevated temps. on the surface of stainless **steel** was investigated as model systems of the processes occurring during the oxidn. of lanthanum coated stainless **steel**. X-ray diffraction (XRD) expts. have shown that $LaCrO_3$ and $LaFeO_3$ are the most stable compds. XRD, chem. anal. and thermogravimetric expts. have demonstrated that in the case of Cr_2O_3, nitrate anions are able to oxidize Cr(III) to Cr(VI) resulting in a precursor phase of perovskite structure that influences the corrosion inhibition of stainless **steel** at high temps.
IT **1344-43-0**, Manganous oxide, processes **12018-15-4**, Chromium manganese oxide (Cr_2MnO_4)
(reaction of lanthanum nitrate with metal oxides in scale formed at high temps. on stainless **steel**)
RN 1344-43-0 HCA

CN Manganese oxide (MnO) (8CI, 9CI) (CA INDEX NAME)

Mn=O

RN 12018-15-4 HCA
CN Chromium manganese oxide (Cr2MnO4) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Cr	2	7440-47-3
Mn	1	7439-96-5

CC 55-10 (Ferrous Metals and Alloys)
ST stainless **steel** scale lanthanum nitrate reaction
IT Scale (coating)
(reaction of lanthanum nitrate with metal oxides in scale formed at high temps. on stainless **steel**)
IT 12017-94-6, Chromium lanthanum oxide (CrLaO3) 12022-43-4, Iron lanthanum oxide (FeLaO3)
(reaction of lanthanum nitrate with metal oxides in scale formed at high temps. on stainless **steel**)
IT 1308-38-9, Chromium oxide (Cr2O3), processes
(reaction of lanthanum nitrate with metal oxides in scale formed at high temps. on stainless **steel**)
IT 1309-37-1, Ferric oxide, processes 1313-99-1, Nickel oxide (NiO), processes **1344-43-0**, Manganous oxide, processes 10099-59-9, Lanthanum nitrate 11109-50-5, AISI 304 **12018-15-4**, Chromium manganese oxide (Cr2MnO4)
(reaction of lanthanum nitrate with metal oxides in scale formed at high temps. on stainless **steel**)

L18 ANSWER 10 OF 17 HCA COPYRIGHT 2004 ACS on STN
109:153977 Local diffusion microwelding of **steel** under the action of a laser. Gubenko, S. I.; Varavka, V. N.; Yatsenko, Yu. V. (Dnepropetr. Metall. Inst., Dnepropetrovsk, USSR). Metallovedenie i Termicheskaya Obrabotka Metallov (5), 13-15, 1 plate (Russian) 1988. CODEN: MTOMAX. ISSN: 0026-0819.
AB Diffusion bonding of inclusions with laser-heated matrix was evaluated for strip specimens of **steels** ShKh15, NB-57, R6M5, 08kp, 08Yu, 08T, 08Kh, and 12GS. The inclusion types were oxides, sulfides, and silicates, and they were evaluated as stress concentrators in a tensile test. Elongation of 10-15% promoted local deformation near the inclusions, and interphase cracks were typically formed only at higher strain.
IT **1344-43-0**, Manganese oxide, uses and miscellaneous

12018-15-4, Chromium manganese oxide (Cr_2MnO_4)
(**steel** strip with inclusions of, laser heating of, debonding elongation after)

RN 1344-43-0 HCA

CN Manganese oxide (MnO) (8CI, 9CI) (CA INDEX NAME)

Mn=O

RN 12018-15-4 HCA

CN Chromium manganese oxide (Cr_2MnO_4) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Cr	2	7440-47-3
Mn	1	7439-96-5

CC 55-12 (Ferrous Metals and Alloys)

ST **steel** bonding inclusion laser heating; deformation **steel** inclusion laser bonding

IT Laser radiation, chemical and physical effects
(**steel** strip heated with, inclusion bonding in, elongation for debonding of)

IT 11103-16-5, 08Kp, uses and miscellaneous 12597-69-2, **Steel**, uses and miscellaneous 12725-23-4, R6M5 12725-40-5, ShKh15 12743-51-0, 08Yu, uses and miscellaneous 56589-51-6, uses and miscellaneous 61952-39-4, uses and miscellaneous 83215-71-8, uses and miscellaneous 85368-44-1, preparation
(laser-heated, inclusions bonded in, elongation for debonding of)

IT 1308-38-9, Chromium oxide (Cr_2O_3), uses and miscellaneous 1317-37-9D, Iron sulfide (FeS), eutectic mixt. with iron oxide or iron manganese sulfide or iron chromium manganese sulfide 1317-61-9, Iron oxide (Fe_3O_4), uses and miscellaneous 1344-28-1, Aluminum oxide (Al_2O_3), uses and miscellaneous **1344-43-0**, Manganese oxide, uses and miscellaneous 1345-25-1D, Iron oxide (FeO), eutectic mixt. with iron sulfide **12018-15-4**, Chromium manganese oxide (Cr_2MnO_4) 12068-51-8 12068-52-9, Aluminum manganese oxide (Al_2MnO_4) 13478-48-3 13776-74-4 109166-62-3D, Iron manganese sulfide ((Fe,Mn)S), eutectic mixt. with iron sulfide 116846-02-7D, Chromium iron manganese sulfide ((Cr,Fe,Mn)S), eutectic mixt. with iron sulfide
(**steel** strip with inclusions of, laser heating of, debonding elongation after)

L18 ANSWER 11 OF 17 HCA

109:77286 Surface analysis of PM martensitic **steel** before and

after consolidation. Part 1. Surface analysis of powder. Nyborg, L.; Olefjord, I. (Dep. Eng. Met., Chalmers Univ. Technol., Gothenburg, Swed.). Powder Metallurgy, 31(1), 33-9 (English) 1988. CODEN: PWMTAU. ISSN: 0032-5899.

AB Surface anal. of Fe12Cr martensitic **steel** powder was performed using electron spectroscopy for chem. anal. and AES. The analyzed powder was produced by N gas atomization, the av. particle size being 190 µm. In the as atomized condition the powder is covered by particles of Mn, Cr, and Fe oxides, as well as a thin (3 nm) layer mainly consisting of Fe2O3. The av. thickness of the oxide particles is .apprx.13 nm, whereas the total av. oxide thickness is .apprx.7 nm. The compn. and thickness of the surface oxides are independent of powder particle size in spite of the difference in cooling rate between large and small metal particles. The liq. metal droplets solidify at ≤1400°. Most of the oxide is formed during solidification. It is suggested that a mixed oxide (MnCr2O4) is produced. Above 1400° no metallic oxide is formed due to the oxidn. of C to CO. At very high temps. Mn evaps. During cooling, the Mn gas is condensed and oxidized on the surface. As a result, a thin layer of MnO is produced on top of the previously formed oxides. Owing to surface depletion of the alloying elements the oxide formed at lower temps. during handling of the powder is Fe oxide.

IT **1344-43-0P**, Manganese oxide (MnO), preparation
12018-15-4P, Chromium manganese oxide (Cr2MnO4)
(formation of, on iron **alloy** powder **surface** during atomization)

RN 1344-43-0 HCA
CN Manganese oxide (MnO) (8CI, 9CI) (CA INDEX NAME)

Mn=O

RN 12018-15-4 HCA
CN Chromium manganese oxide (Cr2MnO4) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Cr	2	7440-47-3
Mn	1	7439-96-5

CC 55-4 (Ferrous Metals and Alloys)
Section cross-reference(s): 79

ST martensitic **steel** powder surface analysis; manganese oxide **steel** powder surface; iron oxide **steel** powder surface; chromium oxide **steel** powder surface; stainless

steel martensitic powder oxide
IT Atomization
(pneumatic, of martensitic iron-chromium **alloy**, particle **surface** oxide formation in)
IT 1308-38-9P, Chromium oxide (Cr2O3), preparation 1309-37-1P, Iron oxide (Fe2O3), preparation **1344-43-0P**, Manganese oxide (MnO), preparation **12018-15-4P**, Chromium manganese oxide (Cr2MnO4)
(formation of, on iron **alloy** powder **surface** during atomization)

L18 ANSWER 12 OF 17 HCA COPYRIGHT 2004 ACS on STN
104:133819 Protecting effect of an oxide layer on chromium-nickel **steel** tubes in pyrolysis furnaces. Tuma, Hanus; Ciznerova, Miroslava; Vyklicky, Miloslav (Statni Vyzk. Ustav Mat., Prague, Czech.). Chemicky Prumysl, 36(1), 8-11 (Czech) 1986. CODEN: CHPUA4. ISSN: 0009-2789.
AB On the basis of thermodn. data, an equil. temp. was detd. for the oxide/carbide systems formed on Cr-Ni **steel** pyrolysis tubes. The oxide surface layer, formed in the beginning of the pyrolysis or during C deposit burning during regeneration, prevents carburization of the tubes. Cr-formed Cr2O3 or spinel layer is reduced above 1000°. Other stable oxides are SiO2 and Al2O3. Alloying with Nb, Mo, and W decreases carburization due to their carbide formation.
IT **1344-43-0P**, preparation **12018-15-4P**
(formation of, on **steel** tubes in pyrolysis furnaces, for carburization prevention)
RN 1344-43-0 HCA
CN Manganese oxide (MnO) (8CI, 9CI) (CA INDEX NAME)

Mn═O

RN 12018-15-4 HCA
CN Chromium manganese oxide (Cr2MnO4) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Cr	2	7440-47-3
Mn	1	7439-96-5

CC 55-10 (Ferrous Metals and Alloys)
Section cross-reference(s): 51
ST **steel** tube oxide layer pyrolysis; carburization **steel** tube pyrolysis

IT Carburization
(of **steel** tubes, in pyrolysis furnaces, oxide layers for prevention of detrimental)
IT Pipes and Tubes
(**steels**, carburization of, in pyrolysis furnaces, oxide layers for prevention of)
IT 1313-99-1P, preparation 1333-82-0P 1344-28-1P, preparation **1344-43-0P**, preparation 7631-86-9P, preparation **12018-15-4P** 12018-18-7P 12068-77-8P
(formation of, on **steel** tubes in pyrolysis furnaces, for carburization prevention)

L18 ANSWER 13 OF 17 HCA COPYRIGHT 2004 ACS on STN
85:169788 Flux growth of crystals of some magnetic oxide materials: Mn7SiO12, CuO, MCr2O4, MTiO3, Ni2NbBO6, MMoO4 and Li2M2(MoO4)3, (M = Mn, Co, Ni). Wanklyn, B. M.; Wondre, F. R.; Davison, W. (Clarendon Lab., Univ. Oxford, Oxford, UK). Journal of Materials Science, 11(9), 1607-14 (English) 1976. CODEN: JMTSAS. ISSN: 0022-2461.
AB The flux growth of crystal of the title compds. was studied. The crystals were characterized by x-ray powder patterns and electron probe microanal. Empirical formulas are given. Two of the materials also occur naturally as minerals: Mn7SiO12, braunite, and CuO, tenorite.
IT **12502-82-8**
(crystn. and x-ray diffraction of)
RN 12502-82-8 HCA
CN Manganese oxide silicate (Mn7O8(SiO4)) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	8	17778-80-2
O4Si	1	17181-37-2
Mn	7	7439-96-5

IT **1309-54-2 12018-15-4**
(crystn. of, flux)
RN 1309-54-2 HCA
CN Braunite (Mn7O8(SiO4)) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	8	17778-80-2
O4Si	1	17181-37-2
Mn	7	7439-96-5

RN 12018-15-4 HCA

CN Chromium manganese oxide (Cr2MnO4) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Cr	2	7440-47-3
Mn	1	7439-96-5

CC 75-1 (Crystallization and Crystal Structure)
Section cross-reference(s): 77

IT **12502-82-8**
(crystn. and x-ray diffraction of)

IT **1309-54-2** 1317-38-0, properties 1317-92-6 12017-01-5 **12018-15-4** 12018-18-7 12032-74-5 13762-14-6 14013-15-1 14177-55-0
(crystn. of, flux)

L18 ANSWER 14 OF 17 HCA COPYRIGHT 2004 ACS on STN

85:164575 Improvement of rust resistance and bendability of 17% chromium stainless **steel**. Yano, Shuya; Nakanishi, Kyoji; Ooi, Hiroshi; Fujimoto, Katsumi; Mihara, Yasuo; Iwaoka, Shoji (Res. Lab., Kawasaki Steel Corp., Chiba, Japan). Transactions of the Iron and Steel Institute of Japan, 16(5), 258-67 (English) 1976. CODEN: TISJBB. ISSN: 0021-1583.

AB To improve the corrosion resistance and bendability of 17%-Cr stainless **steel** [11109-52-7], the effects of nonmetallic inclusions were investigated. The H2O solubilities of synthesized oxides and sulfides similar to nonmetallic inclusions were examd. in relation to the rust resistance of the **steel**. Localized corrosion is initiated at CaS, Ca aluminate [11104-48-6], and (Ca, Mn)S inclusions. Al2O3 inclusions also provide initiation sites for localized corrosion. (CaO)0.55(Al2O3)0.45 dissolves rapdily in salt water at a rate comparable to those of CaS and Al2S3 [1302-81-4]. SiO2, TiO2, or MnO decrease the soly. of (CaO)0.55(Al2O3)0.45 in salt water. The compns. of sol. oxides in the CaO-Al2O3-SiO2 system are roughly restricted to the range <40 wt.% CaO and >30 wt.% SiO2. The effect of Al2O3 inclusions may be caused by the pptn. of CaS by Al or by the effect of Al2O3 on the surface smoothness of the **steel**. The pptn. of Al2O3 inclusions is avoided if the sol. Al content is <0.004%. Under these conditions, the pptn. of Mn chromite [**39432-73-0**] inclusions is ensured if the Mn/Si ratio is kept >1.4:1. These inclusions do not affect either rust resistance or bendability. The S content must also be kept as low as possible.

IT **39432-73-0**
(inclusions, in ferritic stainless **steel**, bendability and corrosion resistance in relation to)

RN 39432-73-0 HCA
CN Chromium manganese oxide (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	x	17778-80-2
Cr	x	7440-47-3
Mn	x	7439-96-5

IT **1344-43-0**
(inclusions, in ferritic stainless **steel**, calcium aluminate soly. in salt water in relation to)
RN 1344-43-0 HCA
CN Manganese oxide (MnO) (8CI, 9CI) (CA INDEX NAME)

Mn=O

CC 55-9 (Ferrous Metals and Alloys)
ST chromium stainless bendability corrosion; bendability chromium stainless **steel**; corrosion chromium stainless **steel**; stainless **steel** chromium bendability corrosion; inclusion chromium stainless bendability corrosion
IT Calcium sulfide, solid soln. with manganese sulfide
Manganese sulfide (MnS), solid soln. with calcium sulfide
(inclusions, in ferritic stainless **steel**, corrosion initiation by)
IT 1344-28-1, reactions
(corrosion initiation by, in ferritic stainless **steel**)
IT **39432-73-0**
(inclusions, in ferritic stainless **steel**, bendability and corrosion resistance in relation to)
IT **1344-43-0** 7631-86-9, properties
(inclusions, in ferritic stainless **steel**, calcium aluminate soly. in salt water in relation to)
IT 13463-67-7, properties
(inclusions, in ferritic stainless **steel**, calcium aluminate soly. in salt water in relation to)
IT 20548-54-3
(inclusions, in ferritic stainless **steel**, corrosion initiation by)
IT 1302-81-4 11104-48-6
(inclusions, in ferritic stainless **steel**, effect on bendability and corrosion resistance in)

L18 ANSWER 15 OF 17 HCA
84:48178 Investigation of chromium-containing oxide inclusions in

steel. Bruch, J.; Meier, Hans H. (Edelstahlwerk, Witten A.-G., Witten, Fed. Rep. Ger.). Mikrochimica Acta, Supplement, 6, 93-104 (German) 1975. CODEN: MKASAK. ISSN: 0076-8642.

AB In studying the effects of Cr2O3 [1308-38-9] inclusions on the polishability of Cr-Ni-Mo **steels**, procedures for excellent characterization of oxide inclusions were developed. The results of combined use of electron-microprobe anal. and isolation of phases were confirmed. Two different Mn-Cr-Al spinel phases were discovered, indicating a mixt. gap between Cr2MnO4 [**12018-15-4**] and Al2MnO4 [12068-52-9]. The structures and compns. of these spinels were established. These phases were found in ferro chromium [11114-46-8] and the gap is believed to be present in the Al2O3 [1344-28-1]-Cr2O3 tempered synthetic slag system. MnO [**1344-43-0**] (27-31%) was isolated from 3 melts and 11% TiO2 [13463-67-7] from one. Silicate glass phases with undetd. Al2O3 contents were found with Cr-Mn spinels in 1 melt.

IT **1344-43-0**
(inclusions of, in alloy **steels**)

RN 1344-43-0 HCA

CN Manganese oxide (MnO) (8CI, 9CI) (CA INDEX NAME)

Mn═O

IT **12018-15-4**
(inclusions of, in alloy **steels**, characterization and isolation of)

RN 12018-15-4 HCA

CN Chromium manganese oxide (Cr2MnO4) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Cr	2	7440-47-3
Mn	1	7439-96-5

CC 55-7 (Ferrous Metals and Alloys)

ST oxide inclusion alloy **steel**; spinel inclusion alloy **steel**

IT Spinels
(inclusions, in alloy **steels**)

IT 1344-28-1, uses and miscellaneous **1344-43-0** 13463-67-7, uses and miscellaneous
(inclusions of, in alloy **steels**)

IT 1308-38-9, uses and miscellaneous **12018-15-4** 12068-52-9
(inclusions of, in alloy **steels**, characterization and isolation of)

L18 ANSWER 16 OF 17 HCA

75:67931 Dependence of the activity of oxidation catalysts on the oxygen bond energy. Boreskov, G. K.; Popovskii, V. V.; Sazonov, V. A. (Inst. Katal., Novosibirsk, USSR). Osn. Predvideniya Katal. Deistviya, Tr. Mezhdunar. Kongr. Katal., 4th, Meeting Date 1968, Volume 1, 343-54. Editor(s): Eidus, Ya. T. "Nauka": Moscow, USSR. (Russian) 1970. CODEN: 23JHAH.

AB The bond energy of O on the catalyst surface was evaluated by isotope exchange reactions. The catalytic activity in relation to the homomol. isotope exchange of O can be used as characteristic of the bond energy and the reactivity of the O of the surface of oxides with an equil. content of O. For detg. the bond energy of surface O in oxide catalysts, the temp. dependence of the O pressure in the bivariant region where its elimination does not yet produce a new phase must be known. An app. was developed for measuring the O pressure over the oxide at 10-4-10-1 torr. The catalytic activity of the oxides of the metals of the 4th period decreases in the series Co3O4>CuO≥NiO≥MnO3>Cr2O3>Fe2O3>ZnO>V2O5>TiO2. This series coincides with increasing bond energy of O on the oxide surface. The correlations were verified on binary oxides of spinel structure, viz. cobaltites and chromites. The catalytic activity of cobaltites of various metals with regard to homomol. O exchange changes by 3 orders of magnitude, the energy of activation from 8 to 25 kcal/mole. For chromites, the change is one order of magnitude and the energy of activation 33-54 kcal/mole.

IT **12018-15-4**
(catalysts, for oxidation of hydrogen and methane)

RN 12018-15-4 HCA

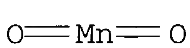
CN Chromium manganese oxide (Cr2MnO4) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Cr	2	7440-47-3
Mn	1	7439-96-5

IT **1313-13-9**, uses and miscellaneous
(catalysts, for oxidn., oxygen bond energy in relation to)

RN 1313-13-9 HCA

CN Manganese oxide (MnO2) (8CI, 9CI) (CA INDEX NAME)



CC 67 (Catalysis and Reaction Kinetics)

IT Bonds

(energy of, of oxygen at transition **metal** oxide **surfaces**)
IT 7782-44-7, properties
(bond energy of, detn. of, on transition **metal** oxide **surfaces**)
IT 12013-31-9 12016-69-2 12017-35-5 12018-10-9 **12018-15-4**
12018-18-7 12018-19-8 12053-26-8 12139-92-3 12187-36-9
12323-37-4 12323-88-5 12323-90-9
(catalysts, for oxidation of hydrogen and methane)
IT 1308-06-1 1308-38-9, uses and miscellaneous 1309-37-1, uses and miscellaneous **1313-13-9**, uses and miscellaneous 1313-99-1, uses and miscellaneous 1314-13-2, uses and miscellaneous 1314-62-1, uses and miscellaneous 1317-38-0, uses and miscellaneous 13463-67-7, uses and miscellaneous
(catalysts, for oxidn., oxygen bond energy in relation to)

L18 ANSWER 17 OF 17 HCA COPYRIGHT 2004 ACS on STN
64:33733 Original Reference No. 64:6187h,6188a Nonmetallic inclusions in **steel**. IX. The iron oxides. Kiessling, R.; Lange, N. Jernkontorets Annaler, 149(6), 322-30 (Swedish) 1965. CODEN: JERNAF. ISSN: 0021-5902.
AB cf. preceding abstr. Three Fe oxides are known: wustite, magnetite, and hematite. A FeO-Fe2O3 phase diagram shows that wustite never forms below 560° and, therefore, is the rarest oxide, since Mn and Si are preferentially oxidized at this temp. Microscopic and x-ray techniques for identification of all 3 phases are discussed. Magnetite usually appears as an important component in the oxide scale formed when Fe is heated in air. Hematite is the only oxide which is strongly anisotropic and is, therefore, easily identified microscopically. Hematite loses O upon heating to produce a magnetite-hematite mixt. Each of the oxides can dissolve other metal oxides such as MnO, MgO, Al2O3, and Cr2O3.
IT **12018-15-4**, Manganese chromate(III), MnCr2O4
(inclusions in **steel**)
RN 12018-15-4 HCA
CN Chromium manganese oxide (Cr2MnO4) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Cr	2	7440-47-3
Mn	1	7439-96-5

IT **1344-43-0**, Manganese oxide, MnO
(soly. in Fe oxide inclusions in **steel**)
RN 1344-43-0 HCA
CN Manganese oxide (MnO) (8CI, 9CI) (CA INDEX NAME)

Mn=O

CC 19 (Ferrous Metals and Alloys)
IT 12597-69-2, **Steel**
(inclusions in)
IT 1309-38-2, Magnetite 1317-60-8, Hematite **12018-15-4**, Manganese chromate(III), $MnCr_2O_4$ 12068-77-8, Iron chromate(III), $FeCr_2O_4$ 17125-56-3, Wustite
(inclusions in **steel**)
IT 1332-37-2, Fe_3O_4, Fe_2O_3
(inclusions of, in **steel**)
IT 1332-37-2, Iron oxide 1345-25-1, Iron oxide, FeO
(inclusions, in **steel**)
IT 1308-38-9, Chromium oxide, Cr_2O_3 **1344-43-0**, Manganese oxide, MnO
(soly. in Fe oxide inclusions in **steel**)
IT 1344-28-1, Aluminum oxide
(soly. in Fe oxide inculsions in **steel**.)
IT 1309-48-4, Magnesium oxide
(soly. of, in Fe oxide inclusions in **steel**)

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L41 ANSWER 1 OF 14 HCA COPYRIGHT 2004 ACS on STN
138:258257 Standard Gibbs free energy of formation of MnO-saturated $MnO\cdot Cr_2O_3$ solid solution at 1873 K. Tanahashi, Mitsuru; Furuta, Nobuo; Taniguchi, Tsuyoshi; Yamauchi, Chikabumi; Fujisawa, Toshiharu (Department of Materials Science and Engineering, Graduate School of Engineering, Nagoya University, Nagoya, 464-8603, Japan). ISIJ International, 43(1), 7-13 (English) 2003. CODEN: IINTEY. ISSN: 0915-1559. Publisher: Iron and Steel Institute of Japan.
AB The std. Gibbs free energy of formation of MnO-satd. $MnO\cdot Cr_2O_3$ solid soln. (stoichiometric $MnO\cdot Cr_2O_3$), which is one of important thermodn. properties of the $MnO-SiO_2-CrO_x$ inclusion system to clarify the equil. relation among molten stainless **steel** and the inclusions formed during the stainless **steel** Si-deoxidn. process, was detd. at 1873 K. By equilibrating molten iron or copper with MnO-satd. $MnO\cdot Cr_2O_3$ crucible under controlled oxygen partial pressure, P_{O2}, the std. Gibbs free energy changes of the following reactions at 1873 K were detd. to be: Mn (%, in molten Fe)+2 Cr (%, in molten Fe)+2 O_2 (g) =$MnO\cdot Cr_2O_3$ (MnO-satd.): ΔG°/kJ=-755±4 (P_{O2}=2+10-6-6+10-5 Pa). The values of ΔG° and $\Delta G_{f,MnO\cdot Cr_2O_3}^\circ$ are independent of the oxygen partial pressure within the P_{O2} range in

the present study.
IT **12018-15-4**, Chromium manganese oxide (Cr2MnO4)
12597-68-1, Stainless **steel**, properties
(std. Gibbs free energy of formation of MnO-satd. MnO·Cr2O3 solid soln.)
RN 12018-15-4 HCA
CN Chromium manganese oxide (Cr2MnO4) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Cr	2	7440-47-3
Mn	1	7439-96-5

RN 12597-68-1 HCA
CN Stainless steel (9CI) (CA INDEX NAME)
*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
CC 55-1 (Ferrous Metals and Alloys)
Section cross-reference(s): 69
IT **12018-15-4**, Chromium manganese oxide (Cr2MnO4)
12597-68-1, Stainless **steel**, properties
(std. Gibbs free energy of formation of MnO-satd. MnO·Cr2O3 solid soln.)

L41 ANSWER 2 OF 14 HCA
136:250799 Oxidation treatment for surface **passivation** on stainless **steel** furnace tubes. Benum, Leslie Wilfred; Oballa, Michael C.; Petrone, Sabino Steven Anthony; Chen, Weixing (Nova Chemicals (International) S.A., Switz.). PCT Int. Appl. WO 2002022910 A2 20020321, 17 pp. DESIGNATED STATES: W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY, DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG, TR. (English). CODEN: PIXXD2. APPLICATION: WO 2001-CA1190 20010820. PRIORITY: US 2000-659361 20000912.
AB The stainless **steel** tubes for hydrocarbon **cracking** and similar applications are **passivated** by surface oxidn. to form spinel film 0.1-15 μm thick of the MnO **.Cr2O3** type. The stainless **steel** tubes are typically heated in 2 stages for 2-40 h at 550-750° and then for 5-50 h at 800-1100° in low-O2 atm. typically contg. steam, H2, CO, and/or CO2. The formation of spinel film decreases the surface content of Fe and Ni as the catalytic metals promoting surface

carburization and coke deposition. The process is suitable for the stainless **steels** nominally contg. Cr 13-50 and Mn 0.2-3.0% with Ni 20-50, Si 0.3-2.0, Ti and/or Nb <5%, and C <0.75%.

IT **12018-15-4**, Chromium manganese oxide (Cr2MnO4)
(film, **passivation** with; surface oxidn. on stainless **steel** furnace tubes for **passivation** with spinel film)

RN 12018-15-4 HCA

CN Chromium manganese oxide (Cr2MnO4) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Cr	2	7440-47-3
Mn	1	7439-96-5

IT **12597-68-1**, Stainless **steel**, processes
(surface, **passivation** of; surface oxidn. on stainless **steel** furnace tubes for **passivation** with spinel film)

RN 12597-68-1 HCA

CN Stainless steel (9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

IC ICM C23C030-00

CC 55-7 (Ferrous Metals and Alloys)

ST stainless **steel** furnace tube surface oxidn spinel; hydrocarbon **cracking** stainless **steel** **passivation** spinel film

IT Hydrocarbons, processes
(**cracking** of, stainless **steel** tubes for; surface oxidn. on stainless **steel** furnace tubes for **passivation** with spinel film)

IT **Passivation**
Pipes and Tubes
(stainless **steel**; surface oxidn. on stainless **steel** furnace tubes for **passivation** with spinel film)

IT **12018-15-4**, Chromium manganese oxide (Cr2MnO4)
(film, **passivation** with; surface oxidn. on stainless **steel** furnace tubes for **passivation** with spinel film)

IT 7439-89-6, Iron, processes 7440-02-0, Nickel, processes
(on stainless **steel**, for **passivation**; surface oxidn. on stainless **steel** furnace tubes for **passivation** with spinel film)

IT **12597-68-1**, Stainless **steel**, processes
(surface, **passivation** of; surface oxidn. on stainless

steel furnace tubes for passivation with spinel
film)

L41 ANSWER 3 OF 14 HCA COPYRIGHT 2004 ACS on STN
136:250798 Heat treatment of stainless **steel** furnace tubes for **passivation** with oxide film to prevent carburizing and coke deposits. Benum, Leslie Wilfred; Oballa, Michael C.; Petrone, Sabino Steven Anthony (Nova Chemicals (International) S.A., Switz.). PCT Int. Appl. WO 2002022905 A2 20020321, 27 pp. DESIGNATED STATES: W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY, DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG, TR. (English). CODEN: PIXXD2. APPLICATION: WO 2001-CA1290 20010910. PRIORITY: US 2000-659361 20000912; US 2000-660084 20000912.

AB The stainless **steel** typically contg. Cr 20-50, Mn 1.0-2.5, Nb <1, and Si ≤1.5% with Ni 25-50, Ti <3, and C <0.75% is heat treated for top coating 1-10 μm of MnO **.Cr2O3** type spinel film, esp. with **Cr2O3** interlayer. The stainless **steel** tubes are heated in reducing atm. to 800-1100°, oxidized in O2-contg. gas for 5-40 h, and cooled to room temp., resulting in decreased surface content of Ni and Fe as catalytic promoters of coke deposits. The treated stainless **steel** tubes are suitable for hydrocarbon-**cracking** furnace service with resistance to carburizing and coke deposits.

IT **12018-15-4**, Chromium manganese oxide (MnCr2O4)
(film, **passivation** with; heat treatment of stainless **steel** furnace tubes for **passivation** with oxide film)

RN 12018-15-4 HCA

CN Chromium manganese oxide (Cr2MnO4) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Cr	2	7440-47-3
Mn	1	7439-96-5

IT **1308-38-9**, Chromia, processes
(interlayer, for **passivation** film; heat treatment of stainless **steel** furnace tubes for **passivation** with oxide film)

RN 1308-38-9 HCA

CN Chromium oxide (Cr_2O_3) (8CI, 9CI) (CA INDEX NAME)
*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
IT **12597-68-1**, Stainless **steel**, processes
(surface, **passivation** of; heat treatment of stainless **steel** furnace tubes for **passivation** with oxide film)
RN 12597-68-1 HCA
CN Stainless steel (9CI) (CA INDEX NAME)
*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
IC ICM C22C038-38
CC 55-7 (Ferrous Metals and Alloys)
ST stainless **steel** hot **passivation** spinel film; furnace stainless **steel** tube **passivation** hydrocarbon **cracking**
IT Coke
(deposits, prevention of; heat treatment of stainless **steel** furnace tubes for **passivation** with oxide film)
IT Carburizing
(stainless **steel**, prevention of; heat treatment of stainless **steel** furnace tubes for **passivation** with oxide film)
IT **Passivation**
(stainless **steel**; heat treatment of stainless **steel** furnace tubes for **passivation** with oxide film)
IT **Pipes and Tubes**
(stainless **steel**; hot treatment of stainless **steel** furnace tubes for **passivation** with oxide film)
IT **12018-15-4**, Chromium manganese oxide ($MnCr_2O_4$)
(film, **passivation** with; heat treatment of stainless **steel** furnace tubes for **passivation** with oxide film)
IT **1308-38-9**, Chromia, processes
(interlayer, for **passivation** film; heat treatment of stainless **steel** furnace tubes for **passivation** with oxide film)
IT **12597-68-1**, Stainless **steel**, processes
(surface, **passivation** of; heat treatment of stainless **steel** furnace tubes for **passivation** with oxide film)
IT 74-84-0, Ethane, processes
(thermal **cracking** of; heat treatment of stainless **steel** furnace tubes for **passivation** in thermal **cracking**)

L41 ANSWER 4 OF 14 HCA

136:250782 Heat treatment of stainless **steel** tubes for furnace service with decreased deposition of carbon from pyrolysis. Benum, Leslie Wilfred; Oballa, Michael C. (Nova Chemicals (International) S.A., Switz.). PCT Int. Appl. WO 2002022908 A2 20020321, 16 pp. DESIGNATED STATES: W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM; RW: AT, BE, BF, BJ, CF, CG, CH, CI, CM, CY, DE, DK, ES, FI, FR, GA, GB, GR, IE, IT, LU, MC, ML, MR, NE, NL, PT, SE, SN, TD, TG, TR. (English). CODEN: PIXXD2. APPLICATION: WO 2001-CA1186 20010820. PRIORITY: US 2000-660084 20000912.

AB Heat-resistant stainless **steel** contg. 13-50% Cr and ≥0.2% (esp. 0.7-2%) Mn with the balance as mainly Fe and Ni is heat treated in low-O2 atm. to deplete the surface of catalytic Ni and Fe for prevention of coking of hydrocarbons in high-temp. service. The stainless **steel** is heat treated by: (a) heating at 20-100°/h to 550-750°, and holding for 2-40 h; and (b) further heating to 800-1100°, and holding for 5-50 h, preferably in the atm. contg. steam 0.5-1.5, H2, CO, and/or CO2 10-99.5, and N2, Ar, and/or He 0-88%. The heat-treated stainless **steel** preferably show the surface layer 0.1-15 μm thick of spinel compd., esp. MnO.**Cr2O3**. The process is suitable for stainless **steel** reactor tubes in catalytic **cracking** of hydrocarbons. The stainless **steel** with the surface content of Cr 33.4, Mn 1.1, Fe 18.5, and Ni 43.6% was heat treated to form the less reactive surface contg. Cr 65.9 (mainly in spinel film), Mn 30.2, Fe 1.7, and Ni 1.3%.

IT **12597-68-1**, Stainless **steel**, processes
(**passivation** of; heat treatment of stainless **steel** tube for furnace service with decreased coking ppt.)

RN 12597-68-1 HCA

CN Stainless steel (9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

IT **12018-15-4**, Chromium manganese oxide (MnCr2O4)
(spinel film, stainless **steel** tubes with; hot **passivation** of stainless **steel** tubes for furnace service with decreased coking)

RN 12018-15-4 HCA

CN Chromium manganese oxide (Cr2MnO4) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2

Cr	2	7440-47-3
Mn	1	7439-96-5

IC ICM C23C008-18
CC 55-5 (Ferrous Metals and Alloys)
ST stainless **steel** reactor tube **passivation** coking prevention; spinel film stainless **steel** coking prevention furnace
IT Steam
(furnace atm. contg.; heat treatment of stainless **steel** tube for furnace service with decreased coking ppt.)
IT **Passivation**
(stainless **steel**; heat treatment of stainless **steel** tube for furnace service with decreased coking ppt.)
IT **Pipes and Tubes**
(stainless **steel**; **passivation** of stainless **steel** tubes for furnace service with decreased coking ppt.)
IT 74-84-0, Ethane, processes
(**cracking** of, coking prevention in; hot **passivation** of stainless **steel** tubes for furnace service with decreased coking)
IT 124-38-9, Carbon dioxide, uses 630-08-0, Carbon monoxide, uses 1333-74-0, Hydrogen, uses 7440-37-1, Argon, uses 7440-59-7, Helium, uses 7727-37-9, Nitrogen, uses
(furnace atm. contg.; heat treatment of stainless **steel** tube for furnace service with decreased coking ppt.)
IT **12597-68-1**, Stainless **steel**, processes
(**passivation** of; heat treatment of stainless **steel** tube for furnace service with decreased coking ppt.)
IT **12018-15-4**, Chromium manganese oxide ($MnCr_2O_4$)
(spinel film, stainless **steel** tubes with; hot **passivation** of stainless **steel** tubes for furnace service with decreased coking)
IT 7439-89-6, Iron, uses 7440-02-0, Nickel, uses
(surface, removal of; hot **passivation** of stainless **steel** tubes for furnace service with decreased coking)

L41 ANSWER 5 OF 14 HCA
136:125356 Electrolytic pickling of stainless **steel** studied by electrochemical polarisation and DC resistance measurements combined with surface analysis. Hilden, J.; Virtanen, J.; Forsen, O.; Aromaa, J. (Materials and Manufacturing Technology, VTT Manufacturing Technology, Espoo, FIN-02044, Finland). Electrochimica Acta, 46(24-25), 3859-3866 (English) 2001. CODEN: ELCAAV. ISSN: 0013-4686. Publisher: Elsevier Science Ltd..

AB A tightly adhering oxide scale is formed on stainless **steels** when they are annealed. The removal of the oxide scale and chromium-depleted subscale is one of the most important processes during the stainless **steel** prodn. Electrolytic pickling in neutral sodium sulfate is widely used for oxide scale removal. This study describes the different stages of the oxide scale removal on Polarit 725 (EN 1.4301) stainless **steel** in sodium sulfate soln. A mechanism of the scale dissoln. is also proposed. The dissoln. probably proceeds by the electrochem. reactions of the scale in three successive stages. At the beginning of the pickling process chromium and manganese of the outer oxide layer were preferentially dissolved. When the chromium content of the outer layer decreased, the scale was enriched of iron. The electrode potential was then increased and the scale thickness greatly reduced. Finally a steady state was obtained and a thin oxide layer, rich in iron and silicon, was left on the surface. Silicon could not be removed by the electrolytic pickling and post-treatment in nitric-hydrofluoric acid is required.

IT **12018-15-4**, Chromium manganese oxide cr2mno4
(dissoln. in outer layer on stainless **steel** during electrooxidn.: electrochem. pickling of stainless **steel** in sodium sulfate soln. studied by electrolytic polarization and d.c. resistance measurements combined with surface anal.)

RN 12018-15-4 HCA

CN Chromium manganese oxide (Cr2MnO4) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Cr	2	7440-47-3
Mn	1	7439-96-5

IT **12597-68-1**, Stainless **steel**, properties
(electrochem. pickling in sodium sulfate soln. studied by electrolytic polarization and d.c. resistance measurements combined with surface anal.)

RN 12597-68-1 HCA

CN Stainless steel (9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

CC 72-2 (Electrochemistry)
Section cross-reference(s): 55, 66

ST electrolytic pickling stainless **steel** polarization resistance measurement surface analysis

IT Anodic polarization
Contact resistance
Surface analysis
(electrochem. pickling of stainless **steel** in sodium

sulfate soln. studied by electrolytic polarization and d.c. resistance measurements combined with surface anal.)

IT Pickling
(electrochem.; of stainless **steel** in sodium sulfate soln. studied by electrolytic polarization and d.c. resistance measurements combined with surface anal.)

IT Oxidation, electrochemical
(in oxide scale dissoln. on stainless **steel**: electrochem. pickling of stainless **steel** in sodium sulfate soln. studied by electrolytic polarization and d.c. resistance measurements combined with surface anal.)

IT Scale (deposits)
(oxide; on annealed stainless **steel** in electrochem. pickling study of stainless **steel** in sodium sulfate soln. using electrolytic polarization and d.c. resistance measurements combined with surface anal.)

IT **12018-15-4**, Chromium manganese oxide cr2mno4
(dissoln. in outer layer on stainless **steel** during electrooxidn.: electrochem. pickling of stainless **steel** in sodium sulfate soln. studied by electrolytic polarization and d.c. resistance measurements combined with surface anal.)

IT 11109-50-5, EN 1.4301 **12597-68-1**, Stainless **steel**, properties
(electrochem. pickling in sodium sulfate soln. studied by electrolytic polarization and d.c. resistance measurements combined with surface anal.)

IT 7757-82-6, Sodium sulfate, properties
(electrochem. pickling of stainless **steel** in sodium sulfate soln. studied by electrolytic polarization and d.c. resistance measurements combined with surface anal.)

IT 7440-21-3, Silicon, processes
(post treatment in HNO3-HF soln. for removal from oxide scale on stainless **steel** after electrochem. pickling of stainless **steel** in sodium sulfate soln.)

IT 7664-39-3, Hydrofluoric acid, processes 7697-37-2, Nitric acid, processes
(silicon post treatment in HNO3-HF soln. for removal from oxide scale on stainless **steel** after electrochem. pickling of stainless **steel** in sodium sulfate soln.)

L41 ANSWER 6 OF 14 HCA COPYRIGHT 2004 ACS on STN
133:270023 Effect of double oxide layer on metal-glass sealing. Mantel, M. (Acesita Research Center, Timoteo, Brazil). Journal of Non-Crystalline Solids, 273(1-3), 294-301 (English) 2000. CODEN: JNCSBJ. ISSN: 0022-3093. Publisher: Elsevier Science B.V..

AB One of the main requirements of a metal-glass sealing is hermeticity along with mech. strength of the metal-glass bond. For this purpose, the thermal expansion coeff. of the metal needs to be as

close as possible to the glass expansion coeff. to limit stress development in the glass. Second, an oxide layer should be developed on the metal surface that works as an interface, for the transition from glass properties, gradually, to metal properties. For these purposes, a ferritic stainless **steel** stabilized with titanium was developed. The thermal coeff. expansion of the metal was measured using a Chevenard differential dilatometer. To evaluate adhesion of the oxide film on the metal, oxide spallation after deformation was performed. SEM was done to det. the oxide structure and XPS was performed to analyze the superficial compn. of the oxide. It is shown that chromium affects the thermal expansion coeff. of the metal. A study of the oxide film formed by a thermal treatment under wet hydrogen atm. is presented. During this thermal treatment a double oxide layer is built up. The outer layer, made of a spinel type MnCr2O4 with titanium oxide in the extreme surface, dissolves in the glass. The inner layer, made of a chromia scale ensures the mech. cohesion. Moreover, silicon contained in the **steel** segregates at the metal-oxide interface and decreases metal-oxide adhesion, and consequently metal-glass sealing.

IT **12018-15-4**, Chromium manganese oxide (Cr2MnO4)
(effect of double oxide layer on metal-glass sealing)
RN 12018-15-4 HCA
CN Chromium manganese oxide (Cr2MnO4) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Cr	2	7440-47-3
Mn	1	7439-96-5

IT **12597-68-1**, Stainless **steel**, properties
(effect of double oxide layer on metal-glass sealing)
RN 12597-68-1 HCA
CN Stainless steel (9CI) (CA INDEX NAME)
*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
CC 56-9 (Nonferrous Metals and Alloys)
Section cross-reference(s): 57
ST oxide glass stainless **steel** sealing thermal treatment titania chromia
IT 1308-38-9, Chromia, properties **12018-15-4**, Chromium manganese oxide (Cr2MnO4) 13463-67-7, Titanium oxide, properties
(effect of double oxide layer on metal-glass sealing)
IT **12597-68-1**, Stainless **steel**, properties
298709-25-8 298709-28-1 298709-31-6 298709-34-9 298709-37-2
298709-40-7 298709-42-9 298709-44-1 298709-46-3 298709-48-5
(effect of double oxide layer on metal-glass sealing)

L41 ANSWER 7 OF 14 HCA COPYRIGHT 2004 ACS on STN
133:225927 Effects of Ce, Mo and Si ion implantation on the passive layer composition and high-temperature oxidation behavior of AISI 304 stainless-**steel** studied by soft x-ray absorption spectroscopy. Gutierrez, A.; Lopez, M. F.; Trujillo, F. J. Perez; Hierro, M. P.; Pedraza, F. (Departamento de Ciencia y Tecnologia de Materiales, Universidad Miguel Hernandez, Elche, E-03202, Spain). Surface and Interface Analysis, 30(1), 130-134 (English) 2000. CODEN: SIANDQ. ISSN: 0142-2421. Publisher: John Wiley & Sons Ltd..

AB The influence of Ce, Mo and Si ion implantation on the chem. properties of AISI 304 stainless-**steel** passive and oxide layers was studied by soft x-ray absorption spectroscopy (XAS). Applying this technique at the transition metal 2p absorption thresholds, the compn. and chem. state of the passive layer were detd. A surface Cr enrichment is obsd. for the ion-implanted samples in comparison with non-implanted samples, which can be assocd. with better corrosion behavior. To investigate the effects of ion implantation on the high-temp. oxidn. behavior of AISI 304 stainless-**steel**, the oxide layer formed after an isothermal oxidn. at 1173 K for 32 h was also investigated. The XAS data show mainly the presence of Cr and Mn oxides in the surface region of all samples. The Cr/Fe ratio-a parameter that can be assocd. with the protective character of the oxide scale-is higher for the Si- and Ce-implanted samples than for the as-received sample. The Mo implanted sample has the lowest Cr/Fe ratio, suggesting a poor oxidn. resistance at high temps. in this case.

IT **60645-62-7**, Chromium manganese oxide (Cr3Mn3O8)
(effects of Ce, Mo and Si ion implantation on passive layer compn. and high-temp. oxidn. of stainless-**steel**)

RN 60645-62-7 HCA

CN Chromium manganese oxide (Cr3Mn3O8) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	8	17778-80-2
Cr	3	7440-47-3
Mn	3	7439-96-5

CC 55-10 (Ferrous Metals and Alloys)

ST cerium molybdenum silicon ion implantation **passivation** oxidn stainless **steel**

IT Corrosion
Ion implantation
Passivation
(effects of Ce, Mo and Si ion implantation on passive layer compn. and high-temp. oxidn. of stainless-**steel**)

IT Scale (deposits)

(oxide; effects of Ce, Mo and Si ion implantation on passive layer compn. and high-temp. oxidn. of stainless-**steel**)
IT Oxidation
(thermal; effects of Ce, Mo and Si ion implantation on passive layer compn. and high-temp. oxidn. of stainless-**steel**)
IT **60645-62-7**, Chromium manganese oxide (Cr3Mn3O8)
150547-53-8, Chromium iron oxide (Cr1.3Fe0.7O3)
(effects of Ce, Mo and Si ion implantation on passive layer compn. and high-temp. oxidn. of stainless-**steel**)
IT 7440-45-1, Cerium, uses
(effects of Ce, Mo and Si ion implantation on passive layer compn. and high-temp. oxidn. of stainless-**steel**)
IT 11109-50-5, AISI 304
(effects of Ce, Mo and Si ion implantation on passive layer compn. and high-temp. oxidn. of stainless-**steel**)

L41 ANSWER 8 OF 14 HCA COPYRIGHT 2004 ACS on STN
132:267636 Solid oxide fuel cell interconnector. Virkar, Anil V.; England, Diane M. (Gas Research Institute, USA). U.S. US 6054231 A 20000425, 10 pp. (English). CODEN: USXXAM. APPLICATION: US 1998-122287 19980724.
AB A solid oxide fuel cell interconnector having a superalloy metallic layer with an anode facing face and a cathode facing face and a metal layer on the anode facing face of the superalloy metallic layer, the metal layer including a metal which reacts with Cr2 O3 to form an electronically conducting oxide phase on the superalloy metallic layer. In accordance with one particularly preferred embodiment, a second metal layer is disposed between the metal layer and the superalloy metallic layer, the second metal layer including a metal which does not oxidize in a fuel atm.
IT **12597-68-1**, Austenitic stainless **steel**, uses
(solid oxide fuel cell interconnector)
RN 12597-68-1 HCA
CN Stainless steel (9CI) (CA INDEX NAME)
*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
IT **12018-15-4**, Chromium manganese oxide cr2mno4
60645-62-7, Chromium manganese oxide (Cr3Mn3O8)
(solid oxide fuel cell interconnector)
RN 12018-15-4 HCA
CN Chromium manganese oxide (Cr2MnO4) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Cr	2	7440-47-3
Mn	1	7439-96-5

RN 60645-62-7 HCA
CN Chromium manganese oxide (Cr3Mn3O8) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	8	17778-80-2
Cr	3	7440-47-3
Mn	3	7439-96-5

IC ICM H01M008-10
NCL 429034000
CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 56
IT 7439-88-5, Iridium, uses 7439-89-6, Iron, uses 7440-02-0, Nickel, uses 7440-05-3, Palladium, uses 7440-06-4, Platinum, uses 7440-16-6, Rhodium, uses 7440-22-4, Silver, uses 7440-50-8, Copper, uses 7440-57-5, Gold, uses 11105-45-6 **12597-68-1**, Austenitic stainless **steel**, uses
(solid oxide fuel cell interconnector)
IT **12018-15-4**, Chromium manganese oxide cr2mno4 **60645-62-7**, Chromium manganese oxide (Cr3Mn3O8)
(solid oxide fuel cell interconnector)

L41 ANSWER 9 OF 14 HCA COPYRIGHT 2004 ACS on STN
132:52852 Correlation of non-destructive measurements with structural degradation in stainless **steel** pyrolysis tubes for ethylene **cracking**. Rho, H.; Buchanan, R. C.; Ford, E. A. (Department Materials Science Engineering, Univ. Cincinnati, Cincinnati, OH, 45221, USA). Materials and Corrosion, 50(12), 706-712 (English) 1999. CODEN: MTCREQ. ISSN: 0947-5117. Publisher: Wiley-VCH Verlag GmbH.
AB A com. NDE technique was investigated to monitor structural degrdn. in stainless **steel** tubes used for ethylene **cracking**. In this study, data derived from a non-destructive magnetic measurement technique were compared to magnetic permeability measurements on sample sections taken from ethylene **cracking** tubes. These data in turn were correlated to microstructural and chem. changes occurring in the tubes after various operational conditions. Detailed microstructure and phase anal. on the oxide layer, Cr-denuded zones and oxide phases formed were carried out using Optical, SEM and x-ray diffraction techniques. The microstructural data showed that the Cr-denuded zone, the oxide layer thickness and the spinel phase formation all increased with operational time. These data could be directly correlated to an increase in magnetic permeability and to the NDE effective thickness measurements. Excellent agreement between these two techniques was found, which indicate that magnetic

Mike measurement technique can be used to track metal degrdn. in the ethylene **cracking** pyrolysis tubes.

IT **1308-38-9**, Chromium oxide **Cr2O3**, formation (nonpreparative) **12018-15-4**, Chromium manganese oxide Cr2MnO4
(correlation of non-destructive measurements with structural degrdn. in stainless **steel** pyrolysis tubes for ethylene **cracking**)

RN 1308-38-9 HCA

CN Chromium oxide (Cr2O3) (8CI, 9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

RN 12018-15-4 HCA

CN Chromium manganese oxide (Cr2MnO4) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Cr	2	7440-47-3
Mn	1	7439-96-5

CC 55-10 (Ferrous Metals and Alloys)

ST **steel** pyrolysis tube corrosion nondestructive testing; magnetic permeability **steel** tube scale thickness; oxide scale pyrolysis tube nondestructive testing

IT Magnetic permeability
Thickness
(correlation of non-destructive measurements with structural degrdn. in stainless **steel** pyrolysis tubes for ethylene **cracking**)

IT Testing of materials
(nondestructive; correlation of non-destructive measurements with structural degrdn. in stainless **steel** pyrolysis tubes for ethylene **cracking**)

IT Scale (deposits)
(oxide; correlation of non-destructive measurements with structural degrdn. in stainless **steel** pyrolysis tubes for ethylene **cracking**)

IT **Pipes and Tubes**
(**steel**; correlation of non-destructive measurements with structural degrdn. in stainless **steel** pyrolysis tubes for ethylene **cracking**)

IT **1308-38-9**, Chromium oxide **Cr2O3**, formation (nonpreparative) **12018-15-4**, Chromium manganese oxide Cr2MnO4 12068-77-8, Chromium iron oxide Cr2FeO4
(correlation of non-destructive measurements with structural degrdn. in stainless **steel** pyrolysis tubes for ethylene **cracking**)

IT 12605-30-0, HK40
(correlation of non-destructive measurements with structural degrdn. in stainless **steel** pyrolysis tubes for ethylene **cracking**)

L41 ANSWER 10 OF 14 HCA COPYRIGHT 2004 ACS on STN
115:37111 Relationship between pre-oxidized film structures and corrosion resistance of ferritic stainless **steels** in high-temperature pure water. Yamanaka, Kazuo; Matsuda, Yasushi (Iron Steel Res. Lab., Sumitomo Met. Ind. Ltd., Amagasaki, 660, Japan). Materials Transactions, JIM, 32(4), 360-7 (English) 1991. CODEN: MTJIEY. ISSN: 0916-1821.
AB The effect of pre-oxidn. conditions on metal release of Ti-added SUSXM8 and 410Ti ferritic stainless **steels** in deaerated pure H2O at 488 K was investigated. The pre-oxidn. treatments in the atm. of low O potential, such as high purity Ar gas and high vacuum condition at 1123 K for short time, were effective in decreasing the metal dissoln. The pre-oxide films were composed of outer Ti2O3 and inner MnCr2O4 layers. Therefore, a small quantity of Ti addn. to high-purity ferritic stainless **steels** was effective in decreasing the metal dissoln. through the formation of thin Ti oxide film, together with the suppression of the sensitization, by heat-treatment in the atm. of low O potential. The key factors controlling the metal dissoln. are thickness and deneseness together with chem. compn. of the oxide films.
IT **12018-15-4**, Manganese chromium oxide (MnCr2O4)
(film structure of, on ferritic stainless **steels**, corrosion resistance in high-temp. pure water in relation to)
RN 12018-15-4 HCA
CN Chromium manganese oxide (Cr2MnO4) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Cr	2	7440-47-3
Mn	1	7439-96-5

CC 71-3 (Nuclear Technology)
Section cross-reference(s): 55
ST preoxidized film structure ferritic **steel**; titanium effect **passivation** stainless **steel**; ferritic stainless **steel** corrosion water; stainless **steel** corrosion water; **passivation** ferritic stainless **steel** titanium; corrosion resistance **steel** pure water; high temp water corrosion resistance **steel**; radioactivity redn **steel** LWR; reactor radioactivity redn **steel** LWR
IT **Passivation**

(of ferritic stainless **steels** contg. titanium, in high-temp. pure water)
IT Radioactivity
(redn. of, from corrosion products of ferritic stainless **steels** in high-temp. pure water)
IT Nuclear reactors, water-cooled
(LWR, radiation buildup in, deposition of radioactive corrosion products from ferritic stainless **steels** in water in relation to)
IT 1344-54-3, Titanium oxide (Ti2O3) **12018-15-4**, Manganese chromium oxide (MnCr2O4) 12068-77-8, Iron chromium oxide (FeCr2O4)
(film structure of, on ferritic stainless **steels**, corrosion resistance in high-temp. pure water in relation to)
IT 7440-32-6, Titanium, properties
(**passivation** of ferritic stainless **steels** contg., in high-temp. pure water, redn. of radioactivity buildup in LWR in relation to)

L41 ANSWER 11 OF 14 HCA COPYRIGHT 2004 ACS on STN
106:75211 Novel applications of Raman microscopy. Gardiner, D. J.; Bowden, M.; Graves, P. R. (Sch. Chem. Life Sci., Newcastle upon Tyne Polytech., Newcastle upon Tyne, NE1 8ST, UK). Philosophical Transactions of the Royal Society of London, Series A: Mathematical, Physical and Engineering Sciences, 320(1554), 295-306 (English) 1986. CODEN: PTRMAD. ISSN: 0080-4614.
AB Raman microscopy is rapidly becoming established as a valuable nondestructive method for examn. and chem. anal. of microscopic samples. The technique uses microscope optics to focus laser light onto a sample and to collect the inelastic (Raman) scattered photons which result. This Raman scattered light provides a vibrational spectrum of the sample with a typical spatial resoln. of around 2 μm. By using this technique, high-temp. corrosion films formed in S and O contg. atmospheres on Ti, Mo, Hf, Ta, Zr, Cu, Fe, and 20/50/Nb stainless **steel**, were characterized. In addn., the nature of a corrosion-inhibition complex formed on Cu was detd. in situ and the mode of interaction of the EP lubricant additive, mercaptobenzothiazole, was investigated by using the SERS effect. Studies of optical fibers, semiconductor films and lubricant films in rolling elastohydrodynamic contacts further illuminate the wide applicability of this technique.
IT **12597-68-1**, Stainless **steel**, properties
(Raman microscopy in study of corrosion films formed on)
RN 12597-68-1 HCA
CN Stainless steel (9CI) (CA INDEX NAME)
*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
IT **12018-15-4**, Manganese chromate (MnCr2O4)
(Raman microscopy in study of corrosion films of)
RN 12018-15-4 HCA

CN Chromium manganese oxide (Cr2MnO4) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Cr	2	7440-47-3
Mn	1	7439-96-5

CC 73-3 (Optical, Electron, and Mass Spectroscopy and Other Related Properties)
Section cross-reference(s): 51, 55

IT 7439-89-6, Iron, properties 7439-98-7, Molybdenum, properties 7440-25-7, Tantalum, properties 7440-32-6, Titanium, properties 7440-47-3, Chromium, properties 7440-58-6, Hafnium, properties 7440-67-7, Zirconium, properties **12597-68-1**, Stainless **steel**, properties
(Raman microscopy in study of corrosion films formed on)

IT 1314-23-4, Zirconium dioxide, properties 1314-61-0, Tantalum oxide (Ta2O5) 1317-33-5, Molybdenum disulfide, properties 12017-83-3 **12018-15-4**, Manganese chromate (MnCr2O4) 12055-23-1, Hafnium dioxide 13463-67-7, Titanium dioxide, properties 18855-94-2, Hafnium disulfide
(Raman microscopy in study of corrosion films of)

L41 ANSWER 12 OF 14 HCA COPYRIGHT 2004 ACS on STN

103:74829 Corrosion behavior of nickel base heat resisting alloys for nuclear **steelmaking** system in high-temperature steam.
Abe, Fujio; Araki, Hiroshi; Yoshida, Heitaro; Okada, Masatoshi (Tsukuba Lab., Natl. Res. Inst. Metals, Ibaraki, 305, Japan). Transactions of the Iron and Steel Institute of Japan, 25(5), 424-32 (English) 1985. CODEN: TISJBB. ISSN: 0021-1583.

AB The corrosion behavior of Ni heat-resistant alloys was investigated in steam at 800° and 40 atm, simulating the superheated steam of the nuclear **steelmaking** system. The alloys tested were 5 new alloys developed for the nuclear **steelmaking** system and 1 com. alloy Inconel 617 [37322-28-4]. A protective surface oxide scale, consisting of **Cr2O3** mainly and of MnCr2O4, forms on the alloys except Inconel 617. Internal oxides, consisting of Al and Ti oxides, also form in the alloys contg. Al. For Inconel 617, nodular oxides, consisting of NiO in the outer region and Cr internal oxides in the inner region, form in addn. to **Cr2O3** and MnCr2O4 after 1000 h. No decarburization occurs in each alloy. The effect of alloy compns. on the corrosion behavior is discussed. The rate of Cr depletion resulting from the formation of **Cr2O3**-rich scale is influenced by the presence of MnCr2O4 layer outside the **Cr2O3** scale, and described by a parabolic rate law for the alloys with thin MnCr2O4 layer and by a

cubic rate law for the alloys with thick MnCr2O4 layer. Al and Ti, which are more reactive than Cr, improve the resistance to spalling of the **Cr2O3**-rich scale, through a key-on effect by the internal oxides and by the enrichment of Ti oxides at the **Cr2O3** scale/alloy interface.

IT **12018-15-4P**
(formation in scale, in nickel heat resistant alloy corrosion by high temp. steam)

RN 12018-15-4 HCA

CN Chromium manganese oxide (Cr2MnO4) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Cr	2	7440-47-3
Mn	1	7439-96-5

IT **1308-38-9P**, reactions
(formation in scale, in nickel heat resistant alloy corrosion by high temp. steam)

RN 1308-38-9 HCA

CN Chromium oxide (Cr2O3) (8CI, 9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

CC 56-10 (Nonferrous Metals and Alloys)
Section cross-reference(s): 51, 55, 71

ST Inconel corrosion steam nuclear **steelmaking**; nickel alloy corrosion steam nuclear; scale nickel alloy corrosion steam; chromia nickel alloy corrosion steam; alumina nickel alloy corrosion steam; titania nickel alloy corrosion steam

IT Iron ores, reactions
(direct redn. of, in nuclear **steelmaking**, nickel heat-resistant alloy corrosion by high-temp. steam in)

IT **Pipes and Tubes**
(nickel alloy, corrosion of heat-resistant, in high-temp. steam)

IT 37322-28-4 65803-93-2 69867-35-2 84896-79-7 84896-81-1 84896-97-9
(corrosion of, by high temp. steam, in nuclear **steelmaking**)

IT **12018-15-4P**
(formation in scale, in nickel heat resistant alloy corrosion by high temp. steam)

IT **1308-38-9P**, reactions
(formation in scale, in nickel heat resistant alloy corrosion by high temp. steam)

L41 ANSWER 13 OF 14 HCA

94:24361 Infrared spectroscopic studies of surface oxides. Ottesen, D.

K.; Nagelberg, A. S. (Sandia Natl. Lab., Livermore, CA, 94550, USA). Thin Solid Films, 73(2), 347-52 (English) 1980. CODEN: THSFAP. ISSN: 0040-6090.

AB Nondestructive optical techniques for the chem. characterization of nonmetallic films on metals were studied. Initial studies were on oxidized samples of 310 stainless **steel** with minor Ti addns. exposed to low O pressures (PO2 .apprx.10-15 atm). As the exposure time was increased from 0.5 to 139 h the oxide scale contained increasing amts. of complex oxide phases such as MnCr2O4, FeCr2O4, and MnTiO3. Binary oxides of Ti and Cr were obsd. at all exposure times. A series of ref. spectra were also obtained for comparison with corrosion scale spectra. Fourier transform IR reflection spectroscopy is an extremely useful tool for characterizing nonmetallic films. It is valuable in supplementing x-ray diffraction for very thin films and provides complementary information to data obtained by light scattering and electron spectroscopic techniques.

IT **12597-68-1**, analysis
(anal. of surface oxides on, by Fourier-transform IR reflection spectroscopy)

RN 12597-68-1 HCA

CN Stainless steel (9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

IT **12018-15-4**
(identification of, in surface oxide layer on stainless **steels** by Fourier-transform IR reflection spectroscopy)

RN 12018-15-4 HCA

CN Chromium manganese oxide (Cr2MnO4) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Cr	2	7440-47-3
Mn	1	7439-96-5

CC 79-5 (Inorganic Analytical Chemistry)

ST surface oxide analysis IR reflection; metal oxide film analysis IR reflection; **steel** oxide film analysis IR reflection; stainless **steel** oxide film analysis

IT **12597-68-1**, analysis 12725-29-0
(anal. of surface oxides on, by Fourier-transform IR reflection spectroscopy)

IT 1308-38-9, analysis **12018-15-4** 12032-74-5 12068-77-8 13463-67-7, analysis
(identification of, in surface oxide layer on stainless **steels** by Fourier-transform IR reflection spectroscopy)

L41 ANSWER 14 OF 14 HCA COPYRIGHT 2004 ACS on STN

92:167381 Oxidation and carburization of high-alloy **steels** for petroleum **cracking** tubes. Part 1. Oxidation behavior in air. Ledjeff, K.; Rahmel, A.; Schorr, Monika (Forschungs-Entwicklungszent., Varta Batterie A.-G., Kelkheim, 6233, Fed. Rep. Ger.). Werkstoffe und Korrosion, 30(11), 767-84 (German) 1979. CODEN: WSKRAT. ISSN: 0043-2822.

AB The oxidn. of cast and wrought **steels** was studied in dry synthetic air at 800-1300°. Oxidn. of DIN1.4848 [39462-01-6] and DIN1.4841 [37268-89-6] followed approx. a parabolic law. Oxidn. of the other **steels** was more complex. The scale layers successively formed on the substrate were **Cr2O3** and MnCr2O4. The **Cr2O3** layer contained SiO2 inclusions, esp. near the metal boundary. The DIN1.4301 [11109-50-5] exhibited increased oxidn. above 1050°. Oxidn. rate of DIN1.4841 at 1100° was higher for the fine grained than for the coarse grained condition. Grain growth impaired formation of a protective layer. The scale contained a considerable amt. of Fe. A transition from internal Si oxidn. to external SiO2 scale formation was found for DIN1.4848 and DIN1.4841 at 1100° in H-H2O mixts.

IT **1308-38-9P**, preparation **12018-15-4**
(scale contg., formation of, during oxidn. of **steel** tubes for petroleum **cracking**)

RN 1308-38-9 HCA

CN Chromium oxide (Cr2O3) (8CI, 9CI) (CA INDEX NAME)

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***

RN 12018-15-4 HCA

CN Chromium manganese oxide (Cr2MnO4) (9CI) (CA INDEX NAME)

Component	Ratio	Component Registry Number
O	4	17778-80-2
Cr	2	7440-47-3
Mn	1	7439-96-5

CC 55-9 (Ferrous Metals and Alloys)
Section cross-reference(s): 51

ST **steel** tube petroleum **cracking** oxidn;
carburization **steel** tube petroleum **cracking**

IT Carburization
Oxidation
(of **steel** tubes, for petroleum **cracking**)

IT **Pipes and Tubes**
(**steel**, for petroleum **cracking**, oxidn. and carburization of)

IT Scale (coating)

(oxide, formation of, on **steel** tubes for petroleum **cracking**)

IT 12605-30-0 37268-89-6 39367-38-9 60412-52-4 73333-36-5
(oxidn. and carburization of, for petroleum **cracking** tubes)

IT 11109-50-5
(oxidn. and carburization of, for petroleum **cracking** tubes)

IT **1308-38-9P**, preparation 7631-86-9P, preparation **12018-15-4**
(scale contg., formation of, during oxidn. of **steel** tubes for petroleum **cracking**)